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THE Waterproof Quality Of Schierens DUXBAK Belting And What It Means To Belt Users

It means more power from the fuel burned

It means an even length of belts in all weathers and climates

It means greater value through its extreme lasting quality.

It means that acid and other fumes have no bad effect on "Duxbak"

It means that the quality is so uniformly superior that Schieren can give the broadest kind of a guarantee

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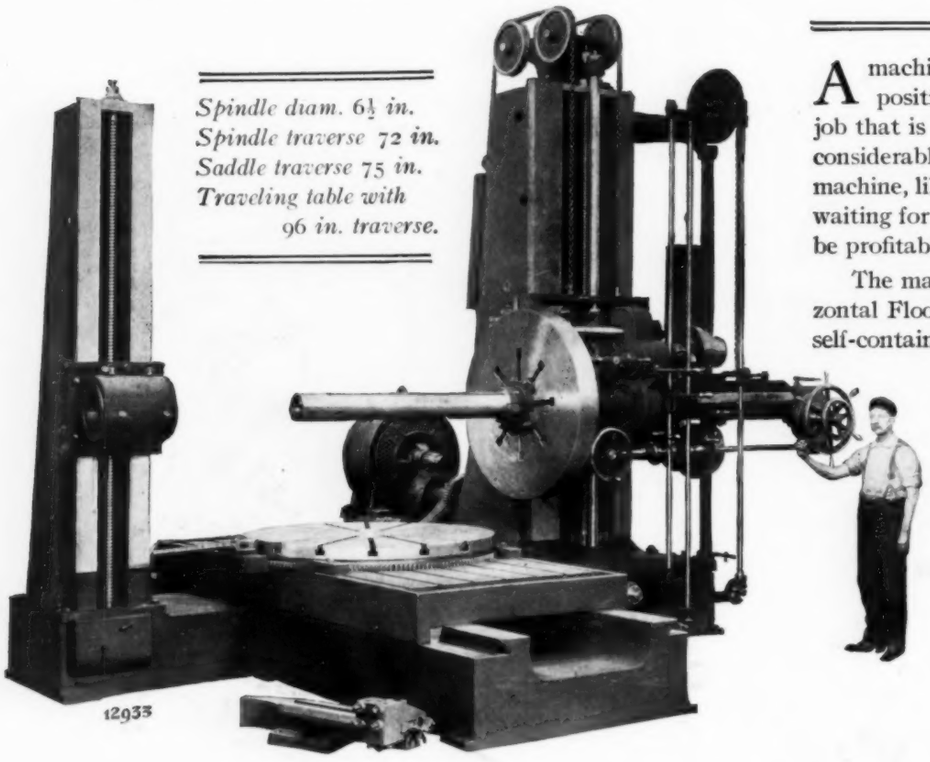
A Machine that Makes a Paying Proposition out of Exceptionally Large and Irregular Work

A machine for the general machine shop that occasionally receives work that is too large or too irregular in shape to be handled on the shop's largest planer. Such work generally has to be sent out to be machined. Handling and rehandling of work sends up production costs to almost prohibitive figures.

A Niles Horizontal Floor Boring Machine in such a shop keeps the work in one shop, does away with an extra large planer that can be used to advantage only occasionally, drills, bores, mills and taps at one setting of the work, does away with excessive handling, and keeps down excessive machining costs.

Niles Floor Boring Machine

A Horizontal Machine for Boring, Drilling, Milling and Tapping Large and Irregular Work at One Operation and without Disturbing the Original Setting



Spindle diam. 6½ in.
Spindle traverse 72 in.
Saddle traverse 75 in.
Traveling table with 96 in. traverse.

A machine that makes a paying proposition out of the accommodation job that is either sent out or done at a considerable loss. And it is not an idle machine, like a large planer that is usually waiting for work that is large enough to be profitably machined on it.

The main column of the Niles Horizontal Floor Boring Machine can be made self-contained and portable, and may be carried to any floor plate in the shop and efficiently operated in any position. It will drill and tap a half-inch hole or end mill the four sides of a casting whose size is limited only by the height of the column and the extent of the floor plate.

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(*See pages* 43, 44, 45 *and* 46)

Some Interesting English Limit Gages

By I. W. Chubb

Two types of Windley gages made by the Crown Works, which include both caliper type and combined caliper and limit gages.

Standard blocks giving many combinations and having their accuracy guaranteed by certificates from the British National Physical Laboratory at Teddington.

The Windley gages, made by the Crown Works, Chelmsford, England, now comprise a set of ordinary adjustable caliper-type gages and adjustable combined limit and caliper gages. The same firm also supply end measuring blocks. Taking the ordinary caliper-type first, Fig. 1 shows a metric set having eight distance blocks ranging from 0.5 millimeter to 30 millimeters, the largest measurement of which the set is capable being 70 millimeters.

An end measuring rod which will expand from 70 to 130 millimeters will be seen in the left-hand side of the case. These sets are, of course, also and more commonly, made to ordinary inch sizes, the nine blocks in the standard set then ranging from 1/64 inch to 1 inch and giving the ordinary outside caliper a range of from 1/64 inch to 2 35/64 inches by sixty-fourths, making 163 sizes. In addition, the internal gage, used, however, chiefly as an end-measuring rod, has a range of 99 sizes from 2½ inches to 4 3/64 inches and 163 gages can be formed by wringing the distance blocks together.

The external gages consist essentially of two hardened, cast-steel arms, each with two surfaces, a boss and anvil, in exactly the same plane. Distance pieces are placed between the two bosses, taking the form of cylinders 1 inch diameter and of required thickness. By means of a ¼-inch central hole and a threaded stud, the arms and distance piece are clamped together, leaving the required gage distance between the anvil faces. This will be readily understood.

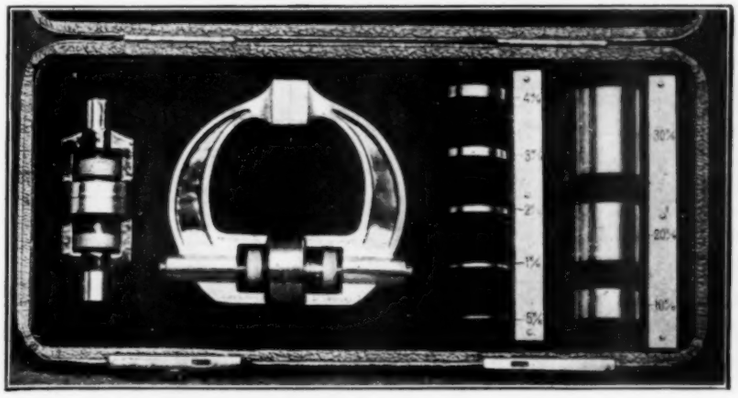


FIG. 1. A SET WITH EIGHT BLOCKS

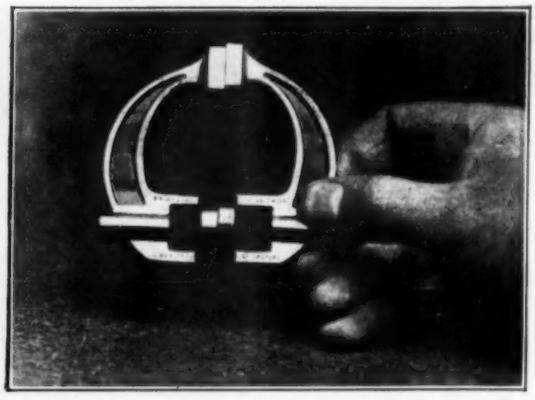


FIG. 2. TESTING ANVILS AND BOSSES

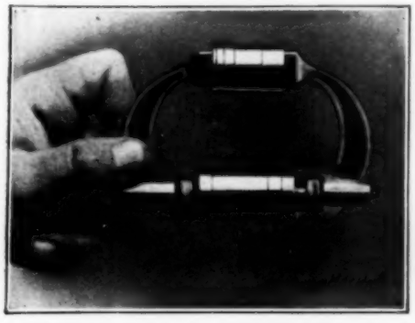


FIG. 3. CHECKING THE ACCURACY

The nuts are placed in recesses and one of them is slit for quick action. It will pass over the thread until it reaches a coned hole in the gage boss, which then closes the thread of the nut on the stud and this tightens the set. It is usual to screw up the nut while the arms make an angle of about 45 degrees with each other. They are then turned into line, thus tightening the nut further. Fig. 2 illustrates the parallelism of the anvils with the bosses, the plane faces adhering to one another.

The end-measuring gages are constructed in much the same way. If for internal work they have spherical ends of rather less than 2½ inches diameter. The set can be carried in the pocket, the case measuring 9x4½x1½ inches, and the whole weighing about 2 pounds.

The set is self checking as illustrated in Fig. 3. Here five pieces at the top are wrung together and tested against a 1-inch and a ⅛-inch block between the bosses. The position being reversed, the same silky feel of the combination of two between the jaws would be experienced. Similarly the internal holder or end-measurer can be tested against the external gage. Fig. 4 illustrates the accuracy of finish of the flat surfaces. The seven gage pieces are merely wrung together against half of the caliper gage.

DOUBLE-ENDED GAGES TO USE IN LIMIT WORK

The double-ended limit set, made for the present only to inch sizes, is shown in Fig. 5. The three faces, anvil, boss and anvil, are in different parallel planes which are at equal distances apart. The anvils are marked + and — at the ends, the + end being, of course, the lowest of the three faces. With the anvils turned so that like signs are opposite one another, the gage is set for limit work, according to the distance between the planes. Reversing one side of the gage, so that unlike signs are opposite, the three pairs of faces adhere and, with suitable distance pieces in place, an ordinary double-ended caliper gage can thus be formed.

Two extra distance pieces are supplied,

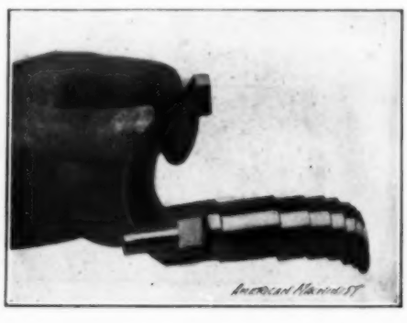


FIG. 4. PIECES WRUNG TOGETHER

namely, 1/64 inch plus the limit and 1/64 inch minus the limit, the limits usual being 0.001 inch, 0.00075 inch and 0.0005 inch. These extra pieces, besides checking the limits of the external measuring holder, can be used for limits in combination with other blocks and also for limits in the end-measuring holder. In all, the sizes obtainable run into thousands by various combinations.

Fig. 6 illustrates the testing of these gages, the ⅜-inch distance piece being placed between the bosses while a combination of five pieces tests the anvil

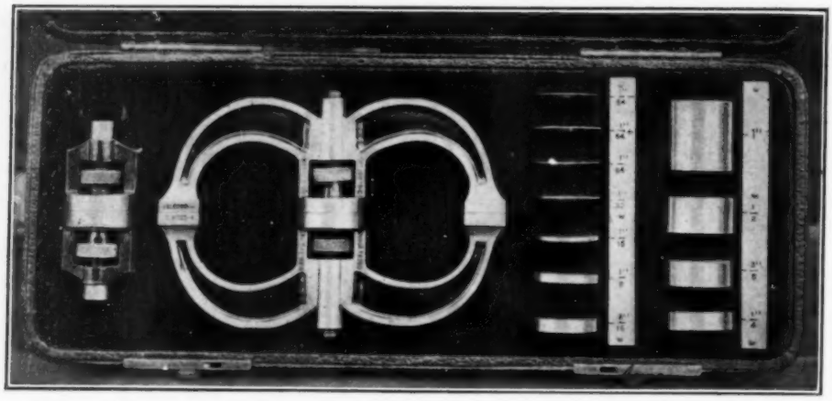


FIG. 5. A DOUBLE-END CALIPER FOR LIMIT WORK

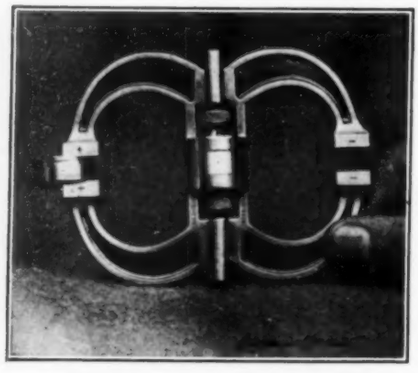


FIG. 6. TESTING THE GAGES

gap. This should be ⅜ plus 0.001 inch, the difference in the planes being 0.0005-inch. The combination used here is of ¼ inch, 1/16 inch, 1/32 inch, 1/64 inch and 1/64 inch plus 0.001 inch. Again by the extra pieces a limit of 0.002 inch can be got, if they are inserted with a combination between the bosses. This is valuable for the larger sizes. The tool is intended for checking shop limit gages and as a master when making new gages. There should be no chance of error, provided the faces are kept clean and free from rust.

END MEASURING COMBINATIONS

The end-measuring gages, Fig. 7, consist of 18 pieces which can be built-up in combinations, thus producing 2448 different sizes. The pieces range from 4 inch to 1/64 inch, with 1/64 inch plus and minus a limit, and the combination may be varied from 1/64 inch to 12¾ inches exactly, or plus or minus the limits as desired. Fig. 8 shows eight of these pieces wrung together and tested against a 2-inch block by means of two other blocks, one at each end.

A workshop use for these blocks is shown in Fig. 9, a hight gage being tested against a 2-inch end block. A combination is also shown wrung together at the side, giving 2 inches plus the limit. True surface plates are necessary for this work and the same firm supply these, mechanically produced, guaranteed true to 1/5000 inch.

In Fig. 10 the jaws of the same gage are being tested for parallelism and also to determine whether the calibration of the slide is correct. This method by the way has been used with a number of micrometers to determine the errors in the screw pitches, F. W. Windley having found this to be necessary.

SETTING FOR FINE WORK

For taking really fine measurements

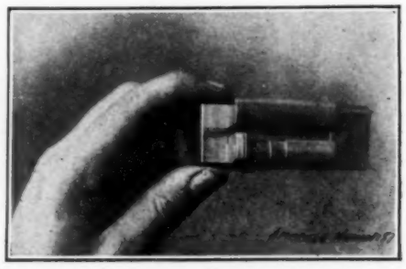


FIG. 8. A SEVERE TEST OF ACCURACY

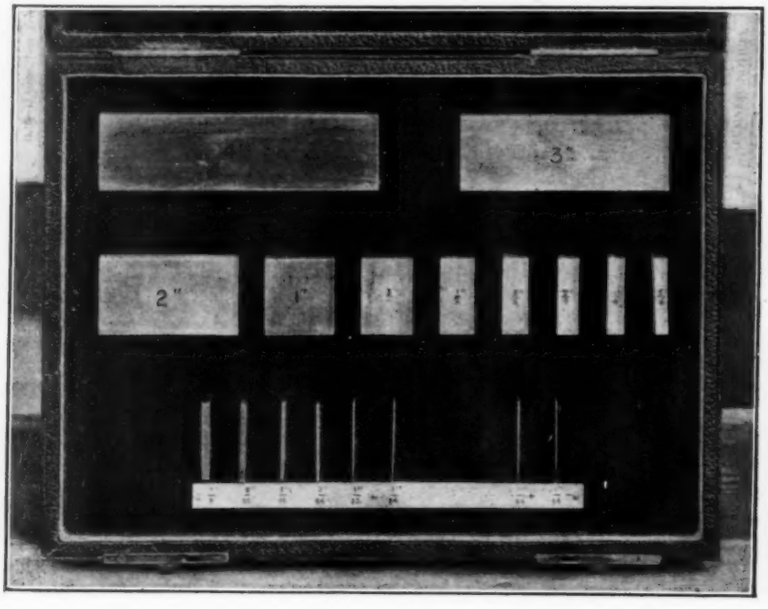
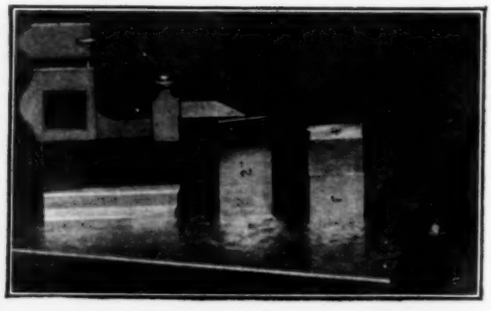


FIG. 7. END PIECES WITH ROUNDED EDGES



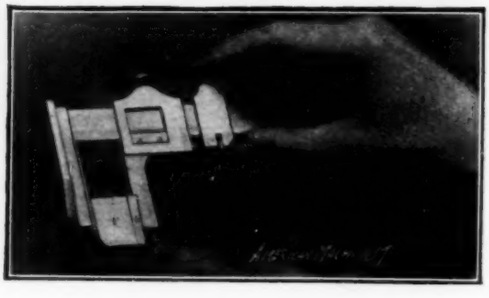


FIG. 9. TESTING A HIGHT GAGE
FIG. 10. TESTING THE JAWS

with the micrometer, the method is to set the tool to the size required by means of the blocks, noting the error in the calibration, and making allowance when testing the work. Working to "half a tenth" in the shop phrase, is then possible with confidence. It is not necessary to refer to the use of the set for the periodical checking of shop gages, for making new gages, for testing jig work, for making jigs themselves and so on.

Certified Accuracy

Obviously these appliances are useless if not true to size and certificates of accuracy from the British National Physical Laboratory, Teddington, can be supplied with each set. The earliest end gages were tested in this way, in the form of cylinders 1 inch diameter with ¼-inch holes, the end faces, of course, being perpendicular to each axis. These gages were compared with the Teddington laboratory standards and the mean lengths at 62 degrees Fahrenheit were found to agree with the sizes marked on the gages. The range was from 1/16 inch to 1 inch. Each gage was tested at several points and the end faces in each case were found to be parallel within 0.0001 inch. This is, of course, the limit to which it is possible to compare with the standard British yard.

High Speed Engine Clearances

By George Hey

For many years the matter of clearances for the fitting of the various running parts of high speed steam engines has been in a very unsettled condition, most manufacturers leaving this important matter to individual judgment of foremen and erectors.

A collection of standard clearances now in use by several leading English engine builders.

The clearances, side play, etc., of the various parts of a high-speed engine are not very generally known. Some makers keep them (or try to keep them) locked up in the safe, and trust the figures only to the gang foremen erecting or assembling the various parts. Other makers, not so uptodate, leave these allowances entirely in the hands of the erectors, with the result that there is no standard at all, as each man uses his own judgment. That these clearances are a very important matter, no experienced engine builder will dispute, and the day of each man's individual judgment should have ceased.

A certain consulting engineer, after putting an engine through its trial runs, commenced inspecting the various parts for signs of wear. For the moment, he was greatly surprised at the amount of clearance and end play given; but, on considering the high temperatures and the expansion of the various metals (some expanding much more than others), he was satisfied that they were necessary. On being shown the tabulated lists, he was some time looking through them, and then requested a copy for his own benefit and use.

In spite of some large clearances, the workmanship must be none the less accurate, as any pins or holes out of line or square, will have a very bad effect, and cause knocking and vibration; two great evils to be guarded against in the high-speed engine. The list of clearances here given was gotten out by one of our leading engine builders, some seven years ago, and there are several other firms which, to my personal knowledge, have since adopted these figures.

Clearances for High-speed Engine Parts

Crankshaft. Endplay not to exceed 0.004 inch on bearing locating shaft; other bearings ⅛ inch or more.

Connecting Rod Bearings. End Travel. 3½ to 5½ inches wide, 1/32 inch; 5¾ to 8½ inches wide, 3/64 inch; 8¾ to 13 inches wide, 1/16 inch.

Bore, Inches.			Clearances in Inches.								
			Wet Steam.			Superheat, 40 Degrees.			Superheated to 100 Degrees and Over.		
H.P.	I.P.	L.P.	H.P.	I.P	L.P.	H.P.	I.P.	L.P.	H.P.	I.P.	L.P.
3½	6½	7⅞	0.003	0.003	0.004	0.004	0.004	0.005	0.004	0.004	0.005
4	6½	8½	0.003	0.003	0.004	0.004	0.004	0.005	0.005	0.005	0.006
6½	8½	10½	0.003	0.004	0.005	0.004	0.005	0.006	0.005	0.006	0.007
6½	8½	11	0.004	0.004	0.005	0.005	0.006	0.006	0.006	0.006	0.007
7	9	16	0.004	0.005	0.006	0.005	0.006	0.007	0.006	0.007	0.008
7	11½	17	0.005	0.006	0.007	0.006	0.007	0.008	0.007	0.008	0.009
8	13	21	0.006	0.007	0.008	0.007	0.008	0.009	0.008	0.009	0.010

Eccentric Straps. Side Play on Sheave. 2 to 2¼ inches wide, 0.007; 2⅞ to 3½ inches wide, 0.014; 3⅝ to 4¼ inches wide, 0.021; 4⅜ to 5 inches wide, 0.030. The amount of clearance on shaft is adjusted by thin liners which are added or taken away as required.

Piston Rod and Valve Rod Brasses. To be 1/32 inch less in overall width than jaws of connecting and eccentric rods.

Piston and Valve Neck Bushes. To be bored larger than rods as follows: 0 to 1½-inch rods, 1/64 inch; 1⅝ to 2½-inch rods, 1/32; 2⅝ to 3½-inch rods, 3/64 inch; 3⅝ to 4½-inch rods 1/16 inch.

Boxes for Metallic Packing. Bored 1/16 inch to the inch larger than diameter of rods.

Glands for Stuffing Boxes. To be turned 1/64 inch under gage.

Pistons. To be turned less than bore of cylinder as follows: 0 to 7 inches diameter, 1/32 inch; 7¼ to 15 inches, 3/64 inch; 15¼ to 25 inches, 3/32 inch; 25¼ to 35 inches, ⅛ inch; 35¼ to 45 inches, 5/32 inch.

Piston Rings. Open at butt as follows: 0 to 7 inches diameter, 3/16 inch; 7¼ to 15 inches diameter, ⅜ inch; above 15 inches diameter, 1/32 inch to every 2 inches diameter.

Piston Valve Ring Clearance (Solid Type). These have been arrived at after some six months' experiment on the test stand, and are as follows:

The matter of bolt-hole clearances has not been dealt with here, although these require to be liberal on parts that are not easy of access, and on parts where jigs are not used. If jigs are used, less clearance will be required.

Running fit allowance for these engines is 0.00025 per inch diameter, except eccentric straps, which have double this allowance.

A machine reported as destined to revolutionize the box-making industry, has been invented and constructed by A. J. Hodge, president of the Reliance Machine Works, Pasadena, Cal. The complete machine weighs 60 tons, will require a floor space of 300x600 feet, and will produce from the raw material 5000 completed boxes every 10 hours. The machine is designed to handle pulp-board stock, 80 per cent. of which material is ordinary sawdust, the remainder being bark, stripping, slabs and other waste materials of lumber camps. Boxes manufactured from pulp board are claimed to be lighter, more durable and safer than the ordinarily made box or crate.

Combined Ball and Plain Bearings

By W. M. Byorkman *

A successful construction in which the merits of both types of bearing are combined.

*Chief draftsman, the Underwood Typewriter Company.

The fulcrum ends of the type bars of the Underwood typewriter, as is well known, work in slots in the segment, and as the alinement of the work depends upon the fit at these joints, a high class of workmanship is required, and the parts are made in very large numbers.

Of the accompanying illustrations Fig. 1 shows the machine on which the work is done. It consists simply of two cup-shaped emery wheels, located at a suitable distance apart, between which the type bars are passed and their thickness determined by the distance between the wheels.

racy required, because of the varying thickness of the film of oil. An adjustment is provided at the end of the spindle by which the parts may be brought together metal to metal and yet without sufficient pressure to injure the thrust bearings. The bearings will be seen to be provided with felt washers and other means of keeping the oil in and the dust out, such as are recommended by the Hess-Bright Company.

The success of the design is shown by the work which it does; namely, about three thousand parts a day to each machine, the variation in thickness being kept within about one-quarter of a thousandth of an inch.

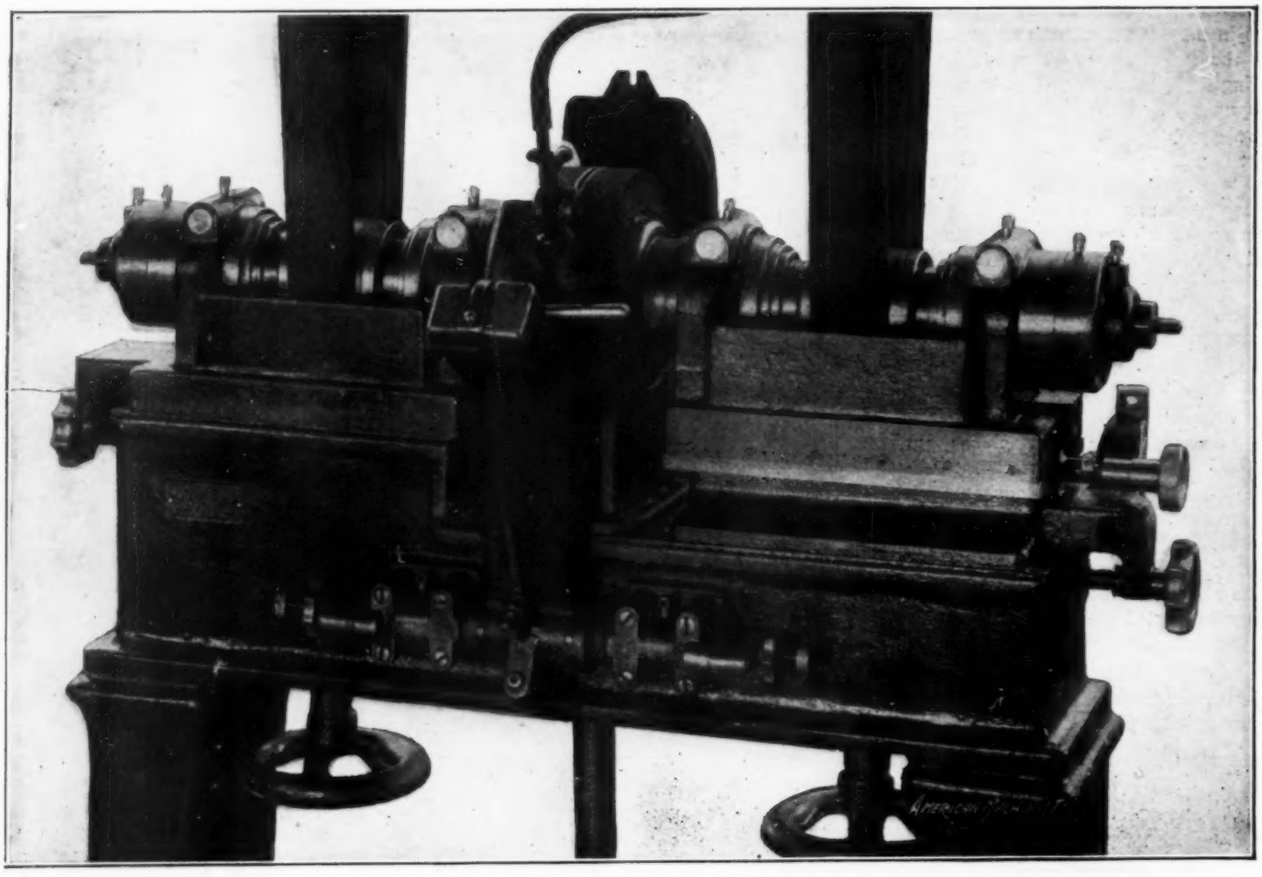


FIG. 1. THICKNESS-GRINDING MACHINE

The point of chief interest about the machine lies in the use of the Hess-Bright combination of ball and plain bearings. The belt pull is taken by the radial ball bearings, but in cases of this kind spindles are found to lack the necessary steadiness when supported by ball bearings alone—a difficulty that has been entirely overcome by the combination bearings.

The general construction will be plain from the sectional view, Fig. 2, from which it will be seen that floating bushings, *A B*, are inserted between the spindle and the surrounding supports. The bushings have a limited motion endwise and have about two one-thousandths play both at the bore and at the external surface. The film of oil seems to act as a cushion and gives the spindle the same steadiness it would have if running in ordinary bearings.

Attention is also called to the self-seating and alining ball thrust bearings of the Hess-Bright type at the end of the spindle, which are an essential feature of the machine. Plain thrust bearings are here inadmissible for work of the accu-

---

In these times when the railroads are claiming difficulty in making ends meet, it seems rather anomalous that they should give reduced summer rates between New York and San Francisco because, based upon 100 degrees difference between winter and summer temperatures, these ends should be just two miles further apart in summer than in winter, due to the linear expansion of the rails.

Grinders and Work Adapted to Them

By M. E. Hoag

I have read the letters and discussions in these columns relative to grinding and grinding machines with some interest, and while I do not wish to pose as a grinding expert, I have had ample opportunity to observe grinding methods and results on practical work.

It is not my intention to condemn nor boost any one make of machine, but rather to make a few statements of actual facts as I have seen them, and while I do think that too many manufacturers rate their machines above their capacity in actual practice, I believe also that the users themselves are largely to blame for not getting a larger output. This statement may be taken as general and not confined to grinding machines alone. I also believe that the grinder manufacturers are somewhat to blame in not insisting that their machines be used on work that is adapted to rapid and economical grinding.

In a small shop where there is little grinding, and that of a widely varied nature, the machine selected must be of a type that will meet all demands, with the result that while the machine will prove a good producer on certain work, there will be many jobs where it will not produce to full capacity, unless it is placed in the hands of a man who thoroughly understands grinding and care is used to properly prepare the work for this particular machine.

In the larger shops where there is an almost constant demand for machines of certain types, it is very poor economy to use a machine that is not adapted to the work.

While the wheel question is one of the utmost importance, it has been harped upon so often, and there is so much valuable information to be had from the wheel manufacturers simply for the asking, that I will say but this: See that your machines are equipped with the proper grinding wheels and then see to it that these wheels are used on the work for which they were intended.

The next question is: What should be expected of a grinding machine? If the users will give this matter a little careful attention and make their castings and forgings to meet *grinding requirements,* they will have less fault to find with machine builders and, in order to make my meaning clear on this point, I will cite a few examples that have come to my notice.

A few years ago a large engine shop in the Central West took up the manufacture of four-cylinder automobile engines cast *enbloc.* When the patterns for the cylinders were made it was the intention of the manufacturers to machine all finished surfaces either by milling or planing, and ample stock was left for finishing. A few months later, when the output was increased, it was found necessary to add to the machine equipment, and a large horizontal grinding machine was purchased. Of course, the machine builders had ample data to show what this machine had been producing on work of this kind, and when the machine was installed, it was put to work on the same castings that were being finished on the milling machines and planers, with the result that it fell considerably short of the claims made for it by the builders and was very unsatisfactory all around. Now, if these cylinder patterns had been changed and but 1/16 inch or 3/32 inch left for finish, instead of from 3/16 inch to ¼ inch, the machine would no doubt have come up to the builders' statements.

This same factory made their own crank shafts, and as it was at first intended to rough turn in a lathe and then finish grind in special machines of a standard make, the forgings were made with considerable stock for finish. Later it was decided to try grinding direct from the rough forgings, and a very close cost account was kept, which showed that, although the time was right, the extra cost of grinding wheels was so great that it was much more economical to do them by the first method. If the forgings had been made with a very small amount of stock for finishing, and then a little care taken in straightening and centering, there is very little doubt in my mind but that grinding from the rough would have been the most satisfactory way of handling them.

I might cite numerous other instances, but these two are typical and are sufficient to show that the users are very often to blame for their own dissatisfaction.

With disk grinders, practically the same conditions prevail as with the other types of grinding machines and many users attempt to do a milling-machine job on a disk grinder, which is not a "hogging machine," and was never intended as such by the builders. In fact, some of the largest manufacturers are now equipping their disk machines with a ring wheel and chuck, to be used where a large amount of stock has to be removed.

When castings and forgings are to be finished on a disk grinder, the stock to be removed should be reduced to the smallest possible amount, and the surface to be finished should be reduced as much as possible by recessing. It should also be remembered that one grade of disk is not suited to all classes of work and material any more than is one grade and grit of wheel.

Let the builders be a little more conservative in their statements and educate the users to know what should be expected of a grinding machine; then, let the users give the subject a little careful study, and the machines a fair test, and things will run more smoothly all around.

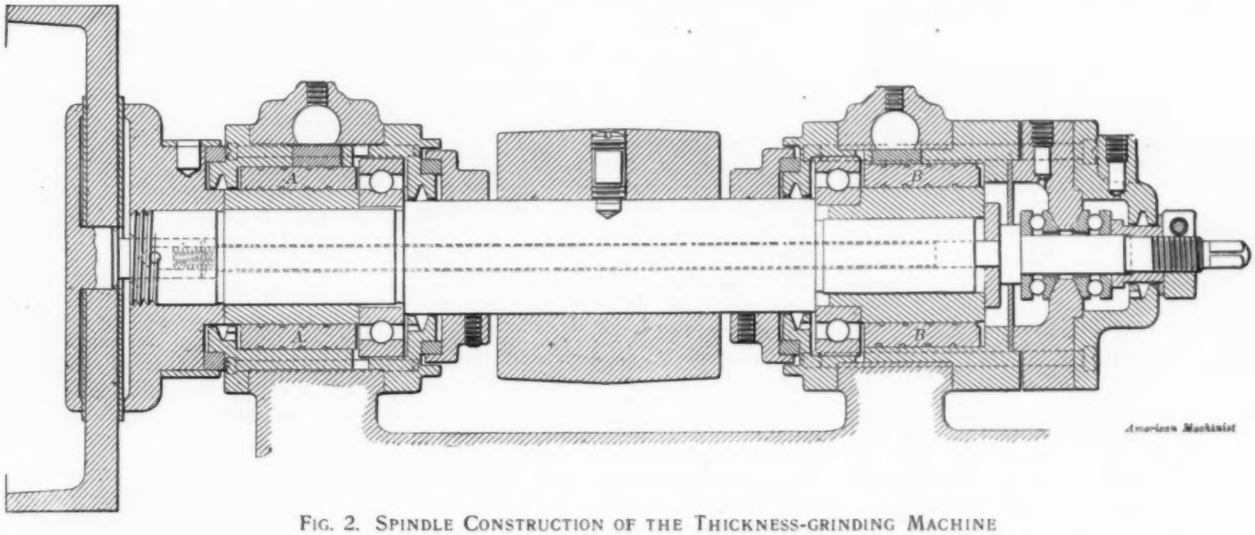


Fig. 2. Spindle Construction of the Thickness-grinding Machine

Designing Special Machinery

By Otto E. Seiffert

Some suggestions for designers of special and automatic machines.

Qualifications necessary in a designer and how his knowledge—both practical and theoretical—should be applied.

Special and automatic machines, whether for ordinary or intricate work, require some preliminary designs or rough layouts. There are a great number of these machines built every year all over the world, in order to reduce the cost of labor and to produce better workmanship. As there is no market for special and automatic machines, they are often built by each concern to suit its special needs. There are also shops which make a specialty of this work. The question of the cost of these machines, of the time to build them, and of the quality and quantity of output to be produced by them, depends much upon the system used in designing them, as well as upon the experience and ability of the designer. At the same time, it is understood that perfect workmanship in the shop is essential to the successful completion of the machine. There are given two methods for designing special and automatic machines.

A Very Common Method

In some factories a special machine is developed in the shop by the foreman without even a drawing, and there is seldom a theoretical basis for all the motions and strength of material to which the machine will be subjected, which makes both the accuracy and durability uncertain. Important parts of a machine are often discarded on account of the lack of foresight by the maker in the shop, which could be avoided if designed in the office. A machine built in this way is usually an indefinite experiment. It will pay to design a special machine in the office under any conditions. No matter if the shop foreman has the original idea of the whole machine, it can usually be improved in various directions, and expenses incurred for the design will be saved in the mistakes averted.

A special-machine design is usually drawn up in a great hurry, it being the idea thereby to save time and expense. A rough layout is made, so as to give the main parts (castings) into the shop as soon as possible, in order to save time. In this way too little attention is given to the theoretical working process of the machine, and the small details when drawn up later are made to suit more the main parts already in the shop, often necessitating complicated devices in order to master difficulties which could have been avoided if the main parts had not been already made.

This method often neglects the principles of the machines, which may not be very clear even to the designer. The speed and action of the tools are often wrong, and great expense is caused in the shop to secure results by the cut-and-try methods. These add to the expense of the machine, and a very poor output often results. All this happens because everything looks very simple and easy at first, but if given the necessary attention, the cause of these difficulties will become apparent. We overlook the fact that an intricate, special machine requires a great deal more study than a well known general machine.

A Better Method

A simple special machine can be designed by almost any draftsman without difficulty, but where it must be very accurate and intricate, there are some points which are not usually observed. The designer should have practical experience as well as a very good theoretical knowledge and should be acquainted with experimental work. As almost everything is new, the designer should have inventive ability, and should be very familiar with the principles of uptodate shop methods, such as knowing where more or less attention is needed on a certain mechanism.

Before the layout is started it will pay to spend some time with the person in charge in discussing the machine to be built. The matters considered should include every question of labor; which kind of man will operate this machine; under what circumstances; the kind of raw material to be used; the limit in accuracy and quality; what output is wanted for the present time and probably for the next few years, in order to get the best results from the machine under the most economical conditions; what tools and what kind of toolmakers are in the shop to build it, and at last the question of first cost is important. All this gives the designer the right idea at the start and he will be better able to design the machine that will fufil the above requirements.

The first thing to find out is what kind of operations are necessary and in what connection the various parts of the work should progress together. As a matter of fact, a designer always tries to use an idea he has seen before, because this is the only way he can know how it works. This plan is easier for him than in the case of a new and untried, but probably better device, where he can see only the difficulties. But before adopting the old idea other methods should be studied, with the object of making all mechanisms as simple as possible, as there are many other ways of producing the same result, and the best one is not always found at first.

In a case where I had to design a special machine similar to another one already in use, I at first forgot this arrangement of the machine and started with the radical idea of designing one which would be more simple. At last I succeeded in designing an automatic machine for the same purpose. This machine gave three times the output, was more accurate and the machine itself was not very much more complicated than the old special machine already in use.

To find the best arrangement of all mechanisms requires often many trials and changes in this layout. In order to make changes as easy as possible, this layout should consist of only the main parts and no time should be wasted in thinking how to make the smaller details before the mechanism of the whole machine looks satisfactory.

As soon as too many details in this layout make a change difficult, the mechanism will be worked out more to suit the details already drawn in than to improve the mechanism itself. The details are only a mechanical question and they will be easily designed to suit the shop and the mechanisms after every mechanical question of the machine has been solved. Each motion, mechanism, speed, power, as well as the working process itself, should be thought over very carefully, and simple facts should be thoroughly investigated as to its correctness in the first place. The simplest facts are often overlooked, and besides the motion used may be useless, which is often discovered after the machine is ready to do work, and means a change of many expensive parts. Everything which leaves the smallest doubt of success should be discussed with the person in charge, as he may view them from a different standpoint, and this will make the designer think them over more carefully.

Where the correctness of motions, etc., cannot be proved in the drawing room, it will pay to try something similar in the shop to make sure of it before going further in designing mechanisms, which may depend on this motion. An intricate part should be worked out on a separate sheet and tried in several directions until it is satisfactory. This usually results in the simplest one being used. If there is a mechanism and the correctness of

it can be properly determined only when the machine is finished, much clearance should be left for it and some other schemes figured out. Then, in case this mechanism does not work satisfactorily, a new one can be easily substituted without changing any other parts.

At last when each mechanism looks satisfactory the whole machine should be gone over once more with the person in charge, who in observing all mentioned conditions may see something of benefit overlooked and many improvements can be made in this way. It should be borne in mind that the proper place to make changes and improvements is when it will be least expensive, and this layout is the best place.

Planning and Drawing Details

The next step will be to think over how to make the details suitable for the shop and durable for wear. It may pay to make a second layout where each detail will be drawn accurately to scale, using as many views and sections as are necessary, to make sure of no interference. All such movable parts as belts, slides and levers should be shown in the position during the operation of the machine, so as to avoid any interference. Everything should be adjustable in order to bring the parts easily to the right fit. The whole machine has to be as rigid as possible so that no vibration or deflection of any part may affect its accuracy. In each drive where the speed is not very positive, cone pulleys or change gears should be provided. Much time is lost when running in the machine in waiting for larger gears or pulleys, but with this arrangement the most economical speed and feed can be found very easily, which would not be tried at all otherwise. The oiling of the tools which need it, for instance, cutting or grinding tools, as well as of the machine itself, should receive much attention.

In drawing the details, I wish to mention several methods which in some cases may be used with success. First, all details may be drawn up without any dimensions. It will be found that in drawing the details, usually on a larger scale than will be used in the layout, many improvements can be made, which may make it necessary to change parts already drawn. This can easily be done without any trouble with dimensions. As on an intricate machine there are often complicated parts to which the toolmakers are not accustomed, I prefer to draw a whole mechanism, if possible, upon one sheet, and perhaps make in one corner of the sheet an assembly of this mechanism. This is a great help for the shop as well as enabling the drawing room to draw the details quickly and correctly the first time. In this way the toolmakers become more familiar with this mechanism, which is more clear than in the main assembly, and they can easily see where more or less accuracy is required.

All details should be shown as complete as possible, showing how they act, or are to be put together—a shaft, for instance, with its cams, pulleys, gears, collars, a bearing with its bolts, oilers and smaller parts which belong to it. In this way much time is saved in the drawing room, as one line and one dimension often serves for two or three parts. In the shop it is easy to see where an accurate fit is necessary, and it is impossible to put parts together wrong. Where jigs and fixtures are required, they should be on the same sheet as the parts where they are used, and in the position in which they are used.

Dimensions and Checking Up

In dimensioning the details I would suggest putting in all dimension lines first without the numbers. In this way the mind is centered in giving dimensions that will make the pieces easy to measure. The dimensions should be brought out of the picture in order to keep it clear. No dimensions in addition should be there. Shop men should not have to add together any dimensions in order to get an overall dimension. After all numbers and remarks are put in, the whole machine needs to be checked up. As the shop needs an assembly to mount the machine in a proper way, a finished assembly may be made from the details already drawn. In this way the machine is thoroughly checked up and all parts are seen to fit. This, in addition to the regular way of checking up, forms a double check and averts mistakes which may have been thus far overlooked.

To Run in the Machine

To run in a machine of this character is often very difficult and its success depends partly on the skillfulness of the mechanics, but especially on the care with which it is guided from the designer. Under any circumstances the designer should investigate everything to see if it works as it was thought out, and if not, how it will affect the quality and quantity of output. If a mechanism works incorrectly, making a change necessary, it should be investigated very carefully, so that the reason may be found and the way to change it without affecting any other properly working part.

I have often found that when a machine to be run in was left only in the hands of the mechanics, so many changes were made that the machine took on another character, and the original idea was often spoiled. This happened because the mechanics had not enough theoretical knowledge to understand the principles of a certain motion and to judge where a change should be made. A machine handled by the right man with the necessary care will soon give a good output, but if handled by the wrong man may not give the output expected.

The second method has the advantage that the design, with reference to accuracy, simplicity and durability, is much better, that the expenses in the shop are less and that the machine will be ready for work sooner. This is because changes for improving the parts have been made at the proper time, where they were less difficult and expensive.

A Cast Iron Line Shaft Running for Seventy-one Years

By Y. E. Killian

A visit to the works of the Griffith & Wedge Company, Zanesville, O., reveals a decidedly interesting feature in the shape of a cast-iron line shaft.

The founders of this concern, organized in 1840, were pioneers in portable-engine building; the principal product today being Corliss engines. The present general manager, C. D. Wedge, is of the third generation.

There is in the "old shop" (as that part of the works is known) a cast-iron line shaft which has been running continuously every working day since the organization of the business, 71 years ago. It is octagonal in section, 4 inches across flats, about 9⅝ inches in diameter, and is cast in sections 12 feet long.

The bearings on the shaft at the hangers are *round*, but it was not possible to ascertain by what method this was accomplished, as mechanics of that day would not hesitate in tackling such a job with hammer, chisel and file if a lathe large enough to accommodate the job was not at hand. But, by whatever method these bearings were produced, they are round today and as smooth as glass.

The hanger boxes are babbitted, and the statement was given that these had likewise been there and doing business every day without rebabbitting for years.

The pulleys on the shaft are all cast iron, and the "bore" is not "bored," but is octagonal, to conform to the shaft and is about ½ inch larger in diameter than the shaft. The pulleys are strung on a section of shafting in their respective positions and set to run true at the rim by wedging them to the shaft. The couplings are secured in a like manner.

This cast-iron line shaft, perhaps the only one of its kind running in the United States, is the only remaining part of the original equipment in the shop, and as it is today driving modern lathes of the heaviest pattern up to 30 inches swing, nor is it recorded that it ever gave any trouble during its past 71 years of service, so that it is reasonable to expect that it will be doing business for many years yet to come.

That the bearings are in such perfect shape is an extremely interesting performance.

Crating Machines for Sea Shipment

By B. Buxbaum*

Ocean freight is roughly handled. Machines for shipments by sea should be strongly boxed and protected against dampness. Light wood parts should be soldered in zinc cases.

Suggestions as to kinds of lumber to use, methods of making crates and boxes and packing the machines. Representative costs of this work in Germany.

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In land transportation of machinery, especially of machine tools, packing in boxes can be avoided when a transhipment is unnecessary, that is to say, when the freight travels in the same car to its destination and is unloaded there. This is restricted to transportation at home and in continental countries having the same railroad gage as the domestic. For such cases it is sufficient either to put the machines on board covered cars, brace them sidewise and suitably fasten them to the car floor, or in a similar manner to make them fast on open cars and protect them from the weather with waterproof covers, such as the railroad officials here will lend for a compensation. In both cases the machined surfaces are coated with acid-free vaseline or other suitable rust preventive, and the light, fragile parts such as countershafts, tools and appurtenances, are packed in light boxes.

Much greater difficulties arise if the packing must be seaworthy, that is, if it must withstand loading by a crane, and also the dampening influence of salt water in a ship's hold. Yet on the whole, there is not so much trouble encountered with machine tools as with many other sorts of iron ware. Such, for instance, is the ocean transportation of a steam boiler where it has to be transhipped in its entirety from an anchored vessel and thus brought to land. On the other hand, for many machines that are to be exported to wild parts of South America, Africa or Central Asia, it is prescribed that the individual parts shall not exceed a weight of 60 or 120 kilograms [132 or 264 pounds] (respectively one-half and one full mule load). Such conditions never could be complied with for medium and heavy machine tools, since the frame of the machine is generally heavier than the minimum weight and it cannot be knocked down like small engines, portable-railway material, machine guns, agricultural machinery, and the like.

Treatment Given to Ocean Freight

The requirements that seaworthily packed goods have to meet are always extraordinarily severe. It must always be taken into account that in loading by a crane the crate is very roughly handled and a warning instruction in any language is either not read or not understood or disregarded. Small boxes are often lifted and moved simply by the crane hooks without chain, in such manner that the points of the hooks cramp and break in the sides of the box. With large boxes something further is done; the hooks are used to tip up the box so that a plank

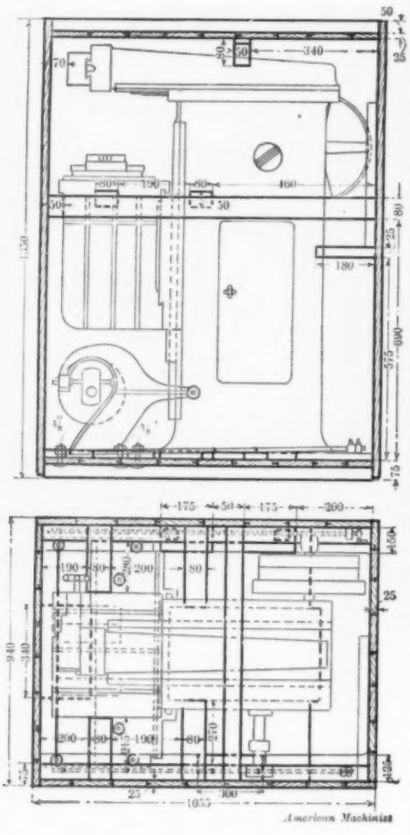


Fig. 1. Boxing of an 18-inch Shaper for Sea Transportation

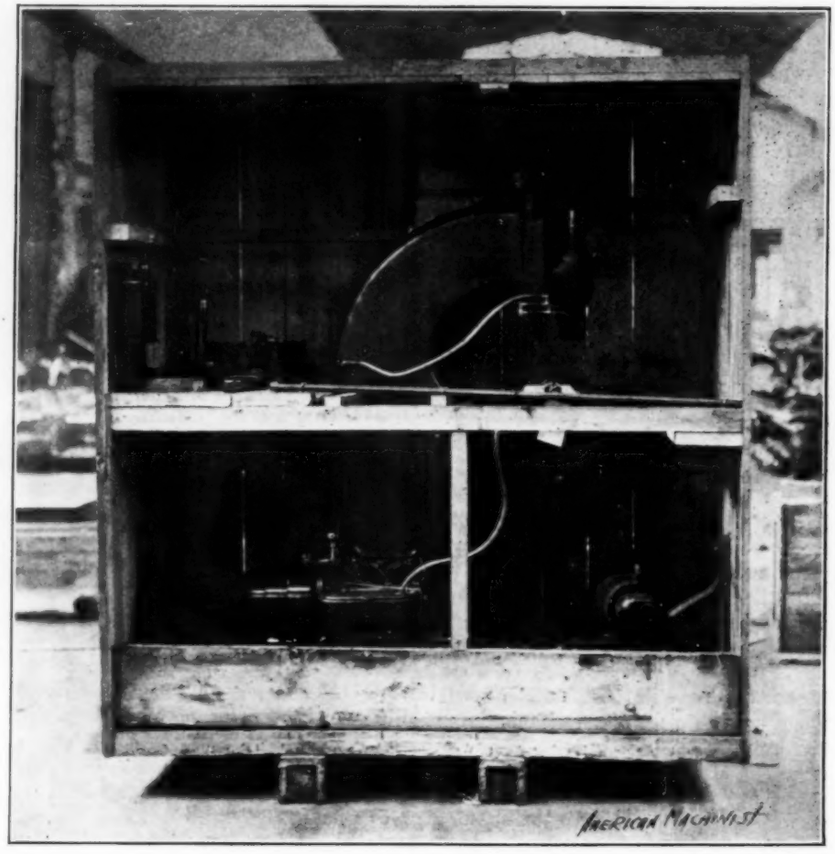


Fig. 2. A Vertical Miller Boxed for Shipment

can be inserted under it for the purpose of passing the chain around. A pushing through of the chain otherwise is impossible, since the edges on which the entire box is built up consist, as a rule, of two cross and two longitudinal strips, so that it rests on the floor all around. How often a transhipment and thus a maltreatment of the crate is necessary natu-

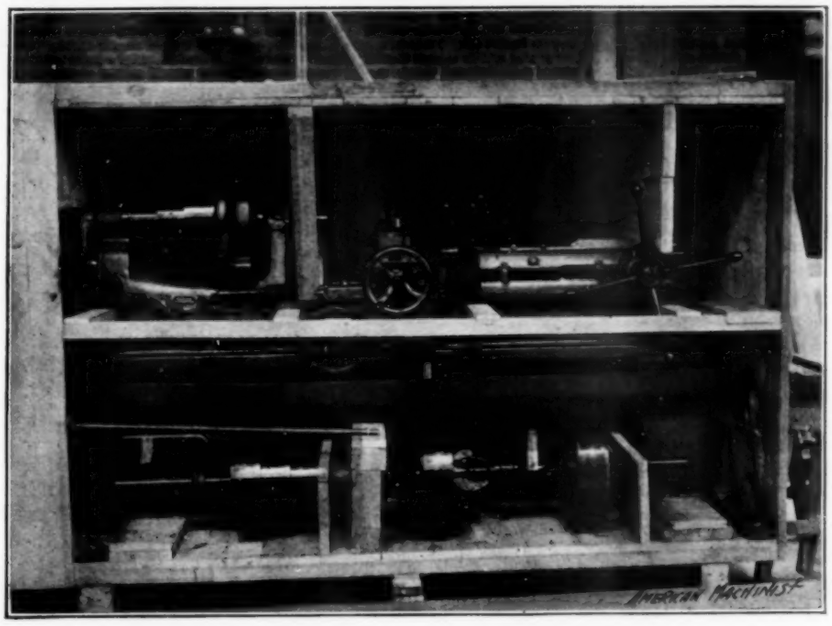


FIG. 3. A TURRET LATHE BOXED FOR SHIPMENT

rally depends on the form of transportation.

First of all, it seems cheapest to send the goods by water to the nearest seaport, in which case they are transhipped from the smaller boat to the ship by means of the latter's own crane. It is evident, of course, that very heavy boxes cannot well be conveyed to the port by water. This method of transportation is especially cheap in the shipment of large quantities, while in sending out single machines of various sizes in medium weights, those firms who have their own railway connections always do better to ship directly by the railroads. In unloading cars on the vessel it often may occur that the machines are too heavy to be lifted by the ship's own crane. In such case the steamer must be shifted to the heavy wharf crane, which naturally increases the expense.

The calculation of marine freights is based either on the volume or the weight of the goods. In computing the individual charges generally "one cubic meter equals a thousand kilograms" [40 cubic feet equals one ton for English measurements] is taken as the normal relation. Goods of heavy specific weight are reckoned by weight, and light ones by volume; so that for example, the anvil of a drop hammer is calculated by weight, while its ram and frame with appurtenant parts may be estimated by cubical contents. The method of applying these rates is, however, too variable to allow laying down fixed rules.

As to the form of packing, it is necessary in shipping very delicate parts to inclose and solder them up in zinc boxes. This is especially the case with wooden pieces, such as wood pulleys, since they might easily be injured by damp air.

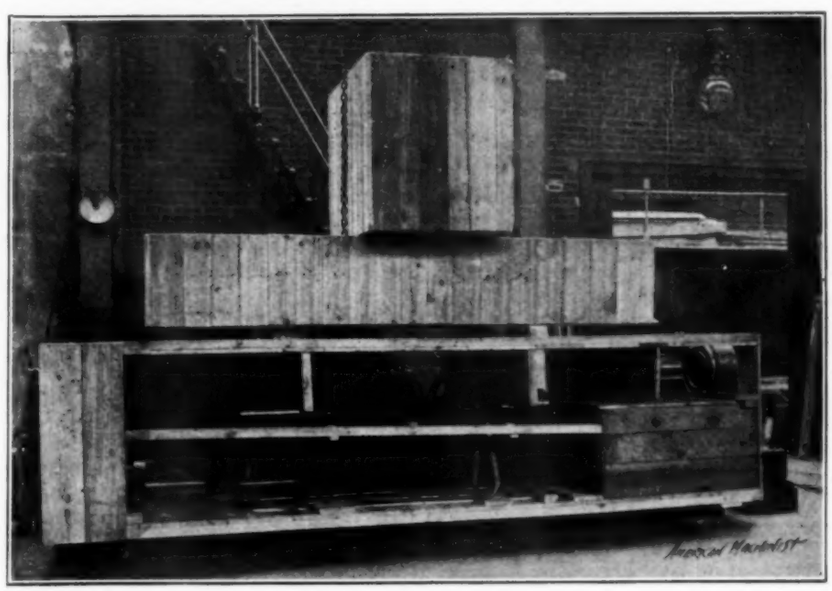


FIG. 4. A LARGE CYLINDRICAL GRINDER BOXED FOR SHIPMENT

Small parts, spindles, etc., may properly be packed in small boxes with an extra wrapping of oiled paper or tar paper, and these boxes can be packed in the large ones. Burlap is not so good for the wrapping since it is hygroscopic. For the crate itself inch planking is generally employed, and the boards must be matched to make them as tight as possible. Under the influence of damp sea air, the joints swell up perfectly tight so that a barrier against sea water is formed without an external cover of burlap. Such a burlap covering has, before all things, an objection that the water which, by any means gets in is retained and the wood dries out with great difficulty; while uncovered boxes, which have become wet soon dry out again. On the other hand, in very careful packing of valuable goods, the boxes are often lined with tar paper or canvas, though in most cases this method may be disregarded. An especially tight jointing of the boards can be obtained by making most of the thick ones somewhat wedge-shaped (in accordance with the form of the tree trunk) so that they tend toward a point alternately upward and downward and are thus easily wedged into place from the opposite ends.

For very heavy machines 1¼-inch boards sometimes enter the question, but these form an exception. The planks or joists to which the end and side walls are primarily nailed have a cross-section of about 2x3 inches and, as already noted, must be laid not only crosswise but lengthwise of the box head, since otherwise the boards of the side walls would not have enough to hold upon.

Beside the above specified requirements for crates which are to be transhipped, come the conditions imposed by the bracing of the machine inside the box. It must be supported and distributed so as to make absolutely sure that the crate can lie in any position without the contents being the least bit displaced.

TYPICAL CRATING FOR MACHINE TOOLS

Fig. 1 shows a correctly and seaworthily packed horizontal shaper of 450 millimeters (18 inches) stroke and a net

weight (including countershaft) of about 1100 kilograms (2420 pounds). It is here seen how the body of the machine is bolted fast to the bottom of the crate by means of four holes in it; how the countershaft is arranged; how the sides of the shaper are protected against contact with the sides of the box and supported by strong, wooden cross braces. Two strips of planking running horizontally, lengthwise of the box, and on which short cross beams are nailed, afford a side support; a cross beam at the top holds the machine above, while about half way down are placed pieces of plank to support the frame before and behind. Beside the bolting of the machine to the floor, wooden blocks are nailed there to prevent sliding upon it.

Fig. 2 shows a crated vertical milling machine of about 2000 kilograms (4400 pounds) net weight; Fig. 3 a turret lathe with net weight of about 2300 kilograms (5000 pounds), and Fig. 4 a crated cylindrical grinding machine (Norton system), which is packed in three boxes; the bed in the lower, the table in the middle and the appurtenances in the upper box. The complete net weight is about 6000 kilograms (13,200 pounds).

All of these views were taken while the front side wall (in Fig. 4 also part of the back side) was not yet completely nailed on, so that the crating might be as clearly seen as possible. The latter three illustrations do not depict seaworthy crates, but packing for land transportation, and they show, therefore, somewhat thinner unmatched boards. In other respects the pictures are so clear that no further explanation should be necessary.

Lumber Used for Ocean-going Crates

In the following will be given a few notes as to the lumber used for seaworthy crates.

It has already been remarked that for such boxes, matched and not merely squared-edged boards should be employed. The latter, that is boards whose edges have merely been freed of bark and planed square, are only to be considered for inland shipment. The matched boards are sometimes not tongued on one edge and grooved on the other, but are either tongued on both edges or grooved on both, so that the box boards may be inserted as desired; that is, so as to utilize their wedge shape by reversing them, and thus to attain absolute tightness. Either the shipper matches the boards himself, or, if it does not pay him to put in a machine for the purpose, or he lacks the requisite space (about 65x85 feet), they can be obtained from the lumber dealer ready tongued and grooved.

In respect to the kind of wood, yellow pine (*Kiefer*) is under all conditions better than white pine (*Fichte*), the best and also the dearest of such material in Germany being the East Prussian yellow pine. Yellow pine contains more resin that white pine, but also has more knots, which, however, does not injure it very much. In the grown trunk should be distinguished three parts as to length: Butt, top and tip, of which for a tree about 65 feet high, the butt wood occupies, say, 32 feet from the root, the top wood 23 feet and the tip 10 feet. Naturally, these are average values. The amounts differ in almost every tree and every sort of wood, and are related to the value of the tree in question.

The section of the butt also is divided into qualities of less and greater value. The outer layers next the bark are made into thin boards for ceiling, wainscotting, etc. The wood lying next to the bark on the side free from branches is used for door panels and the better sort of kitchen furniture, where is required lumber not extremely strong, but well proportioned and clear of knots. The lumber from the middle of the section is most valuable and used especially for building purposes. This is the material preferably employed for seaworthy boards, because of its strength and of its great length and breadth, as also because of its less inclination to shrink, compared with top wood.

The top wood is divided into three classes: The first of these is used for furniture, the second for strong boxes, and the third for ordinary boxes. Lumber that is graded as classes 2 and 3, and knotty wood is suitable for cheap, poor boxes. The average length and breadth of the lumber are about as follows:

1. Butt lumber; length, about 8 meters (25 feet); breadth, about 120 to 350 millimeters (5 to 14 inches); average price for one-inch tapering boards, squared edges, 1.60 marks per square meter (4 cents per square foot); matched edges, 1.90 marks per square meter (4½ cents per square foot).

2. Top lumber; Class 1—Length, about 6 meters; breadth, about 200 millimeters; thickness, 1 inch; average price, 1.50 marks per square meter; thickness, ¾ inch; price, 0.80 mark per square meter. Class 2—Length, about 5 meters; breadth, about 200 millimeters; thickness, 1 inch; average price, 1.30 marks per square meter; thickness, ¾ inch; price, 1.10 marks per square meter. Class 3—Length, about 3 to 4 meters; breadth, 200 millimeters; thickness, 1 inch; average price, ———; thickness, ¾ inch; price, 0.80 marks per square meter.

3. Thin wainscoting, etc.

4. Price about 0.40 to 0.50 mark per square meter.

The total expenses for seaworthy crating naturally cannot be generally stated and are dependent entirely upon the local prices of lumber, which differ greatly, and also upon the various wage rates. As an example, it may be cited that a lathe of 250 millimeters (10 inches) hight of centers and 2000 millimeters (80 inches) between centers, required about 12 hours' working time to pack, so that if two men were at work on the box, the crating time would be about 6 hours. As average values, according to prevailing German conditions, may be given herewith a few prices and weights of seaworthy boxes, which, however, as must be expressly remarked, can have no general application.

Cost of Crating Machine Tools for Ocean Voyage

1. Lathe—Hight above centers, 150 millimeters; distance between centers, 500 millimeters; weight of the machine, about 480 kilograms; cost of seaworthy packing of the machine, about 35 marks; weight increase in percentage of the net weight in kilograms, 40 per cent.

2. Lathe—Hight above centers, 320 millimeters; distance between centers, 3000 millimeters; weight of machine, about 3500 kilograms; cost of seaworthy packing of the machine, about 140 marks; weight increase in percentage of the net weight in kilograms, 25 per cent.

3. Universal milling machine—Table, 300x1500 millimeters; weight of machine, about 300 kilograms; cost of seaworthy packing of the machine, about 95 marks; weight increase in percentage of the net weight in kilograms, 15 per cent.

4. Shaping machine—Stroke, 650 millimeters; weight of machine, about 1300 kilos; cost of seaworthy packing of the machine, about 45 marks; weight increase in percentage of the net weight in kilograms, 20 per cent.

According to the *Foundry*, a formula for a first-class tin babbitt, suitable for severe service, such as street-car motor bearings can be made as follows: Melt 435 pounds of Banca tin in a babbitt kettle and throw on the surface, finely powdered soft coal. While the tin is melting place a clean crucible in the brass furnace and charge therein, 25 pounds of copper; when red hot, add ¼ pound soda ash, a little salt and several handfuls of charcoal. Permit the copper to melt and to become hot, then add 1¼ pounds of bright tin plate, in small strips. Do not drop in all the tin plate at once, as when it becomes hot it will ball and weld together and will, therefore, be in such a condition that it can only be melted with difficulty. Add the tin-plate strips as gradually as possible, and stir between additions, so that all the iron is melted, and to insure this, it may be necessary to superheat the copper for a short time. Then add 6 ounces of sulphur, stir thoroughly, after which add 35 pounds of antimony, and when dissolved, withdraw the crucible and pour the contents into the melted tin, stirring as much as possible, meanwhile.

A Rapid Reduction Engine Lathe

By Hans C. Elvers

The line cuts show a German lathe which has some interesting features not common to American lathes. This particular tool swings 25 inches by 8 feet and weighs 10,500 pounds.

The double back gear is, in reality, a double back gear and not a pair of separate back gears of different ratios, as is common practice here. The lathe has a column at each end and one in the center, each of which is provided with brackets to support the pans *A*, part of which is shown in Fig. 1. The end columns are also provided with gutters *B*, which catch and conduct all drips to the pans *A*.

The machine has a two-speed countershaft, which gives eight cone speeds and eight double back-gear speeds. The spindle has a diameter of 5½ inches in the front bearing, which has a length of 8¾ inches. The front bearing is of bronze and adjustable for wear and provided with a felt pad for continuous oiling. The end thrust is taken at the rear bearing by means of a hardened and ground pin pressed into the spindle and by an adjustable screw. The pin and screw, as well as the rear bearing, have arrangements for continuous oiling. The headstock is fastened to the bed by five screws; two in front, two in the rear and one in the middle.

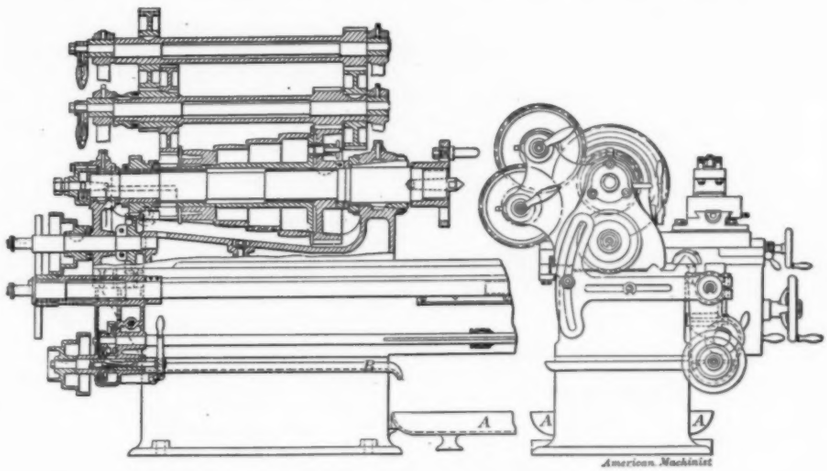


Fig. 1. A German Rapid Reduction Lathe

The cone pulley runs at high speed and is turned internally and runs on an independent sleeve. Cone pulley, rim and pinion are keyed to the sleeve and the large step of the pulley is fastened to the rim of the sleeve by screws. The sleeve has bronze bushes and an oil chamber in the middle.

The feed pinion on the main spindle slides on a sleeve provided with teeth and keyed to the spindle. For thread cutting and turning the pinion is coupled to the sleeve, but if very coarse threads are to be cut, the pinion is coupled with the cone pulley, and as the back gears have a high ratio, a very coarse pitch can be cut with a small ratio in the change gears. The pinion on the main spindle drives an intermediate pinion keyed to the shaft, which runs in two bearings. This is a stronger drive than the rocker gears for left- and right-hand threads usually used. A pair of three-step cone pulleys of large diameter and wide face transmit the drive to a gear nest of two pairs of gears. These gears are operated by a lever and sliding key.

The lathe has an all-gear feed box providing eight feeds and driven by a single belt or by a chain and sprocket wheels. The carriage slides on a V in front and on the flat way at the back. The lead screw and the rack are placed under the V. The carriage is held down on the ways by gibs and is provided with an arrangement for oiling the ways.

The longitudinal feed and the cross feed can be reversed by a handle *C*, Fig. 2, in front of the apron. The arrangement consists of two swinging worms, the one with right- and the other with left-hand threads. The longitudinal and the cross feeds are operated by clutches.

The feed and the thread-cutting arrangement are blocked one against the other. An automatic stop is provided for tripping the longitudinal feed.

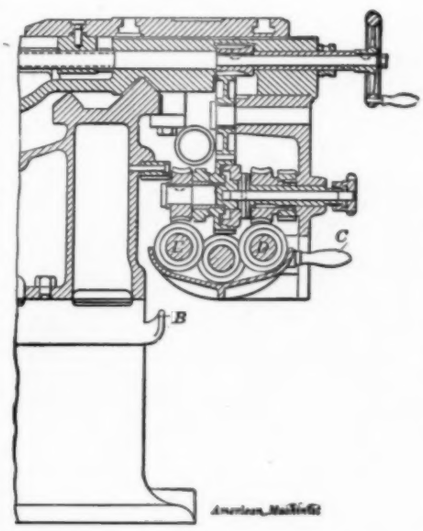


Fig. 2. Cross-section of the Carriage

A Speed Tag

By J. W. Knox

Any progressive superintendent desiring to maintain the output of his machines somewhere near their maximum capacity will be interested in a brief description of how this was accomplished in our factory.

An intelligent apprentice was given the job of testing, with the speed indicator, the revolutions per minute of the work spindle of each machine on the different steps of the cones with the back gear in an out and tabulating the result on a small piece of sheet aluminum as shown in Fig. 1, and attaching this plate to a convenient and accessible place on the machine.

The number on the first line is the factory number, the four different speeds with the back gear out on the next line and below the speeds with the back gear in; should there be a double back gear, another line is added.

No. 833.	R.P.M.			
Open.....	542	308	190	112
Back gear....	56	32	20	12

Fig. 1. Spindle Speed Tag for Machine Tool.

Several blueprints about 6½x8½ inches, suitably mounted on boards and the face shellacked so they can be washed when dirty are hung on hooks in each department so as to be easily accessible to the operators.

These blueprints show the surface-cutting speeds of various dimensions.

Now for example we will say a lathe operator has 200 four-inch diameter cast-iron rolls to turn and his foreman in answer to his question says he can cut cast iron at 60 feet per minute with the tool steel he is using. Referring to his table he finds his work must turn 57 times per minute.

Looking on the aluminum plate he finds the smallest cone with back gear in gives him 56 revolutions per minute, which is nearest for his work and so he shifts his belt accordingly.

A little lard oil rubbed on hardened-and polished-steel work, which is to be drawn on a plate over an open-forge fire, will prevent the smoke from obscuring the tempering color.

Notes on Hindley Gear Hobs

By George F. Summers*

On page 65 of George B. Grant's excellent treatise on gear wheels is described a method of cutting a Hindley worm and gear. It consists essentially of a tool revolving around a center *A*, Fig. 1, the blank for the hob *C* being turned on its axis at the same time to suit the motion of the tool. While nothing is said about the position of the cutting edge of the tool, up and down, it is presumed that it is as shown in Fig. 2. The resulting hob is shown in Fig. 5 and the corresponding worm and gear in Fig. 6. It will be noticed that the end threads in the worm seem to bear and that the middle ones seem to have clearance; that is, the end teeth in the hob have cut larger openings between the teeth of the gear than are needed to fit the middle threads of the worm.

If, instead of using the hob as shown in Fig. 5, we had cut away all of the teeth but those representing one thread in the middle, no reason is seen why a gear cut from such a hob should not fit with reasonable accuracy a corresponding worm of one thread. If, now, we cut teeth in this gear and use it in turn as a hob, a worm cut from it ought to fit the same as even in the middle and fit not so well at the ends, just how well it is very difficult to predict exactly, but probably it would be a better job taken all in all, than that shown in Fig. 6. The making of a gear into a hob involves mechanical difficulties and the result can be approximated by using two additional tools, Figs. 3 and 4, to represent the upper and lower contours of the gear, making three cuts across the hob. Two tools are necessary as the worm is not symmetrical. It probably would have been better if the hob shown had had the teeth cut spirally, instead of parallel to its axis, as a gang of teeth leaving the gear at the same time may cause it to jump slightly, making an uneven spot in the work, which it is, of course, very desirable to avoid.

*Chief draftsman, Rock Island arsenal, Rock Island, Ill.

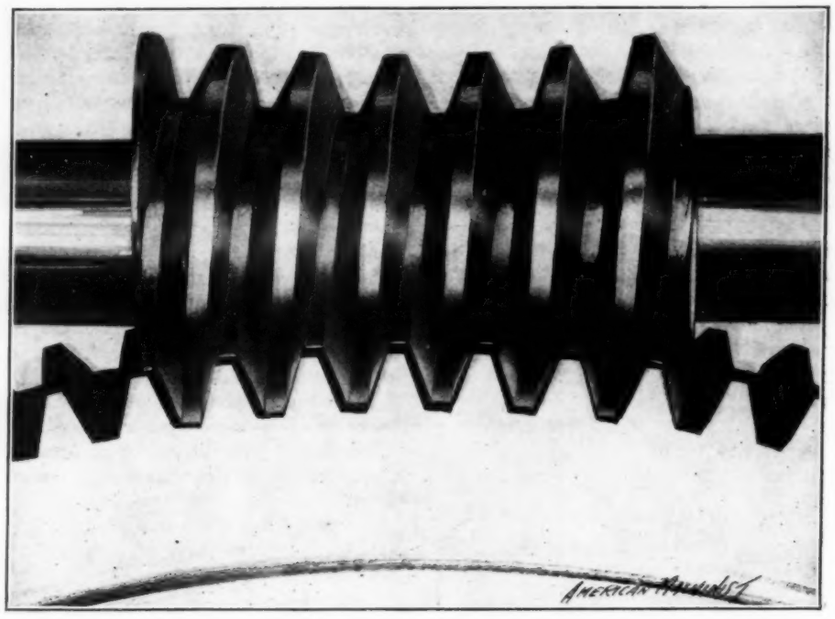
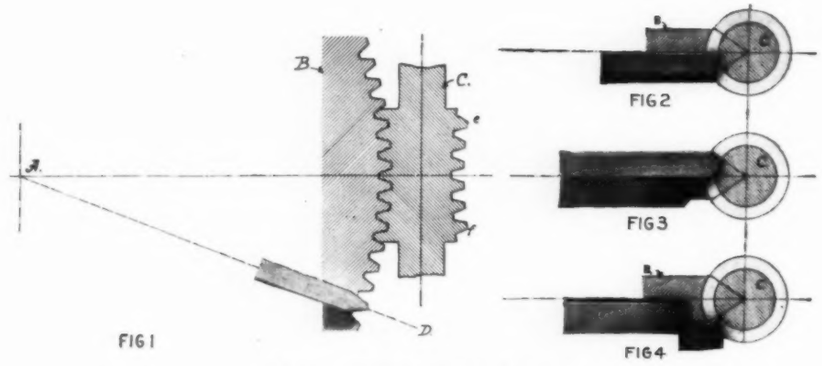


Fig. 6. A Hindley Worm and Gear



Cutting the Hindley Worm

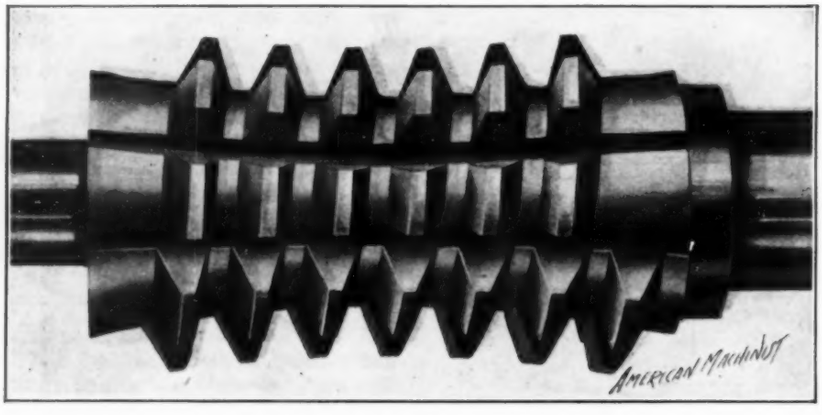


Fig. 5. A Hindley Hob

Recently, Prof. R. A. Fessenden, of Washington, D. C., in a paper presented to the engineering section of the British Association for the Advancement of Science, outlined a plan whereby power on a commercial scale may be obtained from the sun and wind. He proposed to combine wind- and sun-power apparatus in order that a plant might be capable of furnishing a fairly constant output with only moderate storage capacity. His paper aroused considerable interest, especially as he intimated that he has a 3000-horsepower plant under construction at a worked-out copper mine. By locating the plant at the mine it will not be necessary to provide any tower for the upper water-storage reservoir, for it will be built at the mouth of the shaft while the lower reservoir will be placed in one of the bottom chambers of the mine, 1000 feet below. While the opinion is held in many quarters that cost of the proposed plant will so much outweigh the cost of a steam plant of equal capacity that the scheme will be impracticable, the results attained will be of extreme interest.

Efficient Record and Route System—I*

By H. M. Norris†

The scheme of manufacturing machine tools to which this is applied is the unit system, not the single shop-order system.

A fundamental feature is furnishing information upon which the manufacturing schedule may be adapted to the condition of the shipping orders as they change in number and in kind.

Further, the system shows the progress of all orders in the shop, aids in determining time of deliveries, exposes dereliction of duty on those responsible for the manufacturing and frees the executives from a burden of details.

In order to make prompt deliveries, the machine-tool builder is obliged to manufacture for stock. If the concern is a large one its product is usually made in large lots. This, in most lines of work, necessitates placing orders in the shop from three to six months in advance of sales. To those whose product is limited to a few sizes and styles of tools, it is a comparatively easy matter to determine when and for what a new stock order should be issued. But to the manager of a plant engaged in the manufacture of a large variety of sizes and styles the problem is much more serious, as each mistake in judgment is apt to curtail profits in two directions; it not only ties up unnecessary capital, but frequently results in losing orders for machines of other sizes on account of long delivery, due to work for which there is a cessation in demand having been sequenced ahead of them.

The Essentials of a System

All that the manager usually has to guide him in preparing his manufacturing schedule is such information as he is able to glean from the sales and cost records. The first tells him at what rate a certain size and style of machine is selling, together with how many he has left in any particular lot, while from the second he can ascertain what length of time will be required to put through an additional lot. Should he find that a machine has been selling at the rate of 20 per month; that out of the lot in stock, or nearing completion, there are but 60 unsold ones; and that all of three months will be required in which to bring out another lot, he would naturally conclude to issue a new stock order at once. Let us suppose that he does so, and that after six weeks have elapsed he finds that instead of orders for this tool continuing to arrive at the rate of 20 per month, they drop to 10. On this basis he will have sufficient stock to carry him four and a half months. The need for the work to be completed as originally scheduled ceases. But an unprecedented number of orders may have been received for another size or style, sequenced to be finished some weeks after the other. The delivery on the latter should obviously be shortened as much as possible, while that on the former becomes of little importance. This necessitates revising the manufacturing schedule and, as these changes may become desirable with great regularity, one of the fundamental qualifications of the system under which the work can be manufactured successfully is adaptableness to such sequencing.

Besides meeting this requirement of adaptability, it is essential that the system should show what progress has been made on all orders in the shop, make easier the perplexing question of naming deliveries, guard against the overloading of any element used in the construction of a machine, relieve everyone from having to trust to memory for anything, be so automatic as to expose at once any dereliction of duty on the part of those responsible for keeping the work moving, free the manager, superintendent and general foreman from the annoyance of dealing with details and, in short, render every service that will in any way assist in increasing profits.

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†Mechanical engineer, Cincinnati Bickford Tool Company.

The Unit System of Manufacture

In order to obtain these results, the systematist should first familiarize himself with the way in which it has been found expedient to put work through the shop. What is best for one concern may be the worst possible for another; it all depends upon the ramifications of the product. If all machines of a certain size are identical, it is unnecessary to use more than a single shop order in their manufacture; while in such lines as are offered in a number of styles, it is usually desirable to operate under what I have termed the unit system. The company with which I am associated builds one of its radial drills in three lengths of arms, three lengths of bases, four styles of drive, three styles of table and two styles of column. Here we have a multitude of combinations, the demand for any one of which can only be guessed at. To carry every variety in stock is obviously impossible. The single shop order system would not, therefore, meet our needs. We must not be obliged to decide four or five months in advance how a certain lot of machines are to be assembled. If there should be an unusual demand for motor-driven tools, we want to be able, without causing confusion of any sort, to suspend operations on such work as they replace and substitute that which will be wanted first. For these reasons, as well as for many others that might be cited, we have made it our practice to put the work through in units, and as the head is the only part that is common at all, it is made the leading unit of the machine.

7K PRODUCTION LIST
No. 2 PLAIN RADIAL

NAME OF PIECE		SYMBOL	UNITS CHANGED: Arm	Base	Drive	DRAWING	MATERIAL	REMARKS
Plain	Arm	7K1	1			C 1381	C. I.	
Standard	Base	2		1		C 1382	"	
Arm End	Bearing	3	1			C 1383	"	
" Mitre	"	4	1			"	"	
Speed	Box	5			1	C 1384	"	
Arm Shaft	Collar	6	1			C 1385	C R S	
Ratchet Gear	"	7			1	"	"	

Date.....
Del.....Ex.....
THE BICKFORD D. & T. CO., CINCINNATI, O.

American Machinist

FIG. 1. PRODUCTION-LIST FORM—SIZE 4½x10½ INCHES

What Constitutes a Unit

It should be said in explanation of this method of handling the work, that each unit includes only such parts as are not used in any other unit. The arms, as has been said, are made in three lengths,

but the same miters, miter-gear case, outer bearing, bronze bushes, etc., are used on each. These pieces we classify as a distinct unit and manufacture in large lots, while each length of arm, together with its shaft and rack, constitutes another unit and is made in much smaller lots.

The Production List

Before much of anything can be accomplished in the way of devising suitable forms, it is necessary to prepare a production list. This should give the name, symbol and quantity needed, of every piece used in each unit. The most convenient arrangement that I have found for this purpose is shown in Fig. 1, the chief characteristic of which lies in the parts being listed both alphabetically and numerically. This facilitates finding any piece by either name or symbol and, by using a letter suffix to the symbol, is sufficiently elastic to provide for the insertion of such new parts as may be added to the machine from time to time. Should we, for instance, add a part that we wished to name "Counterweight Bracket," we would give it the symbol of 7 K 5 A. This, it will be observed, permits of 26 additions to each original symbol. Another feature of this style of production list consists in a column being provided in which to note, by some arbitrary sign, what pieces have been changed since the machine was placed on the market. As a safeguard against mistakes in furnishing repairs, this is a most important adjunct.

Symbol 3 A 127 Name Dial Depth gauge — 9

Date Made 10-15-06 Date Destroyed Cost $ 8.00

Sent to Bollman & Wilson Date 10-20-06 Ret'd

Sent to Date Ret'd

DRAWING			USED ON	3 A	4 A	5 A	2 C		
G	7843	1	Made first on Shop No.	996	1020				
"	"	2	" " " " "	1124	1160				
			" " " " "						
			" " " " "						
			" " " " "						
			" " " " "						
			Made last on Shop No.						

Fig. 2. Drawing-office Part Record Form—Size 4x6 Inches

NAME OF PIECE		SYMBOL OF PIECE	QUAN.	DR'G NO.	DEP'T & SEQUENCE A	B	C	D	E	F	G	H	I	PREF. 1	2
Arm Shaft	Bearing	3A 100	1	C123				1	2						*
17 T. Tumbler Gear	Bush	101	1	C124	1	2								*	
Sleeve	Cap	102	1	C125					2	1				*	
Arm Shaft	Collar	103	1	C126	1	2			3						*
Elevating Screw	"	104	1	"	1	2			3						*
Mitre Gear	"	105	1	"	1	2			3					*	
17 T. Tumbler	Gear	106	1	C127	1	2		3	4					*	
32 T. Cap	"	107	1	"	1	2		3	4					*	
32 T. Vert. Shaft	"	108	1	"	1	2		3	4					*	

(48) 3 A Frame Units Shop No. (1126) American Machinist

Fig. 3. Guide-sheet Form—Length 8 Inches

The Piece-record Card

Whenever a new piece is designed, or an old one altered or discarded, it is the duty of the drawing office to record this fact on the form shown in Fig. 2. The symbol and name are entered at the top. The next three lines are filled in on such cards only as appertain to work made from a pattern. The "Cost" is entered as an aid in estimating. The three vertical columns under the heading of "Drawings" are for recording the size of sheet, the number and the suffix. By suffix I mean the subnumber which is added to the tracing each time the piece is changed. The spaces at the right are for entering the symbol of such other machines as the piece may later be used upon, together with the number of the shop order on which it was first and last made for each. This is one of the most important features of the card, as it guards against making an alteration on one machine that might be unsuited to another. The reverse of the card is ruled for "Remarks" as well as for entering the number and cost of each jig used in the manufacture of the piece, for what operation each jig is intended, and the number of the shop order under which the piece was first machined with each jig. The cards are kept in the drawing office, filed according to symbol.

Name of Piece.	Symbol.	Q		Drawing.	1	2	Material.	Size.	Length.	Pounds.	D
Drg. sleeve brg.....Cap	7 K 13	1		C1321	*		C.I.				F
Back gear.....Case	7 K 14	1		B1162	*		C.I.				F
Head.....Clamp	7 K 16	1		C1320		*	C.I.				F
Counterweight.....Bridle	7 K 4	1	P	C1320		*	M.I.				B
Stop key.....Collar	7 K 19	1	P	C1323		*	M.I.				A
Head clamping.....Lever	7 K 85	1	P	C1326		*	M.I.				E
22 T drg. miter.....Gear	7 K 37	1	P	C1327	*		S.C.				A
Reverse lever.....Segment	7 K 124	1	P	C1326		*	S.C.				B
Feed change.....Spool	7 K 135	1	P	C1323		*	S.C.				A
Dial.....Bolt	7 K 3	1		C1319		*	M.S.	$\frac{3}{8}$ sq.	4	0.45	A
Chain.....Coupling	7 K 20	2		C1324		*	M.S.	$\frac{3}{16}$	$2\frac{1}{4}$	0.32	A
12 T back.....Gear	7 K 31	1		C1327	*		M.S.	$2\frac{1}{4}$	$19\frac{1}{4}$		B
Feed change gear...Collar	7 K 17	2		C1323		*	C.R.S.	2	$\frac{3}{4}$	0.67	A
Dial bolt.....Collar	7 K 18	1		C1323		*	C.R.S.	$\frac{3}{4}$	$\frac{3}{4}$	0.06	A
20 T feed back.....Gear	7 K 39	1		C1328	*		C.R.S.	$2\frac{1}{2}$	$1\frac{1}{2}$	2.26	A
Feed change.....Key	7 K 69	2		C1322		*	A.T.S.	$\frac{1}{4}$x$\frac{1}{4}$	$2\frac{1}{4}$		D
Spreader.....Key	7 K 78	1		C1325		*	A.T.S.	$\frac{1}{4}$x$\frac{1}{2}$	$10\frac{1}{2}$		E
Trip.....Latch	7 K 81	1		C1319		*	A.T.S.	$\frac{1}{16}$x$\frac{1}{8}$	$2\frac{1}{4}$		D
21 T clutch gear....Bush	7 K 5	2		C1318	*		P.B.				A
45 T clutch gear....Bush	7 K 6	2		C1318	*		P.B.				A
Spindle gear brg....Bush	7 K 12	1		C1318		*	P.B.				A
Feed.....Plate	7 K 97A	1	P	C1320		*					E
Reverse ring.....Spreader	7 K 138	4	P	C1325	*		Forge				E
Spindle thrust.....Washer	7 K 147	1	P	C1323		*	Fiber				B
Feed worm thrust...Bearing	7 K 1	2	S	C1318		*	Ball Bearing No. 12. Style T 100.				E
Rev. spreader adj...Pin	7 K 92	2	S	C1325		*					E
Chain.....Screw	7 K 115	2	S	C1330		*					E

7 K Head Unit. FIG. 4. MATERIAL LIST FORM—SIZE 7½x8 INCHES. Shop No.

The Guide Sheet

The guide sheet, Fig. 3, is used to group the parts into units, the necessity for which in our work has already been pointed out. A print of it is sent to every department foreman through whose hands the work will pass. Its func-

tions are to enable the foremen to secure drawings and study in advance the design of any work that may be new to them, to show each foreman just what work he will have to do on any particular order, to tell him whether he is to look for the work direct from the storeroom or from some other department, to indicate what pieces should be given first and second preference; to make known to him what pieces, if any, are still to come to him; to furnish a convenient means for checking off the work as his part of it is finished, to show him to which department he should send the work for the following operation, and to advise the route clerk upon what date each department completed its work on the order. This last information is imparted by the return of the sheets to the route clerk. In order to provide for units comprising a larger or smaller number of parts, the sheets are made in three lengths, but are so perforated that when placed in their binder, the shop-order numbers lie one above the other, like the page numbers of a book.

STANDARD PARTS LIST GANG NO. ( )

PIECES FOR WHICH PARTS ARE WANTED			PARTS WANTED			TOTAL	
NAME OF PIECE		SYM'L.	SYM.	Q	NAME	SYM.	Q
Main	Bracket	3A 601	H 68	4	Screws Hex. Head	A 45	1
"	"	" 603	P 107	2	Pin, #5 x 2¼	" 46	2
"	"	" 605	P 84	1	" , #4 x 1½	" 66	1
Mitre Gear	Collar	" 609	A 46	2	Screw, C. P. Headless	B 80	2
Back Gear Shaft	"	" 610	A 45	1	" , " " "	H 68	8
25 T. Back	Gear	" 615	A 66	1	" , " " "	P 84	1
Standard	Head	" 634	H 68	4	Hex. Head Screw	P 107	2
"	"	" "	B 80	2	Screw Cup P. & Sq. Hd.		

( ) 3A HEAD UNIT SHOP NO. ( )

FIG. 5. STANDARD-PARTS LIST FORM—LENGTH 8 INCHES

19343
PROGRESS CARD Shop No. 9243
For 12 - No 6 Universal Heads Seq. No. 4

Shop Order Issued	6-5-10	Completed, Dept.	A 5-25-10
Guide Sheet "	6-9-10	" "	B
Material List "	"	" "	C 8-26-10
St'd. P'ts. List "	"	" "	E
Lot Orders "	6-11-10	" "	F
Route Card "	"	" "	G
Requisitions "	"	" "	J 9-3-10
Foundry Ord. "	6-12-10	" "	
Stan'd. Parts "		" "	
Remarks:		" "	
		" "	
		" "	

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FIG. 6. PROGRESS-RECORD FORM—SIZE 4x6 INCHES

The material list, Fig. 4, groups the parts according to units and materials. The drawing office furnishes a print of it to both the route clerk and storekeeper. It gives the name, quantity, symbol, drawing number and material, the size and length of such pieces as are to be supplied by the cutting-off department, the size and individual weight in the rough—including waste—of the bar from which are made such pieces as the screw-machine department furnishes; indicates, by the letter *P*, what parts are purchased on the outside and, by the letter *S*, what parts are carried in stock. The list also shows what pieces should be given first and second preference and to what department each should be sent for the initial operation. It is made in three lengths and filed in a binder according to its shop-order number, the same as the guide sheet.

The standard-parts list, Fig. 5, shows what is required for one unit in the way of such parts as screws, nuts, pins, keys, etc., as are regularly carried in the storeroom. It gives at the left, in alphabetical and numerical order, the name and symbol of the pieces for which the parts are needed; in the middle, the symbol, quantity and name of the parts that are used with each piece and, at the right, in alphabetical and numerical order, the total quantity of parts required of each symbol. This arrangement not only facilitates selecting the parts from their bins in the storeroom, but enables the assemblers to ascertain quickly what parts are to be used in conjunction with any particular piece of work. Two prints are issued with each unit order. Both of these go to the storekeeper, who makes the proper assignments on his material cards, issues requisitions for such additional parts as may be necessary and files them in a binder, according to their shop-order number. Here they remain until the storekeeper is notified that the parts are wanted in the shop, when he places them, together with one of the prints, in a box partitioned and symboled for each set. This box is then sent to the assembling gang whose number appears on the standard-parts list, while the remaining print is dated and signed by the storekeeper and returned to the route clerk who, after he shall have entered its date on the progress card, Fig. 6, passes the print along to the cost clerk.

19342
SALES CARD. RADIALS.

Size No. 6 Style Full Universal
Arm 7 ft Drive Gear Table Plain
Sales No. 1600 Assem. No. 9900 Mach. No. 1870
Name Plate Prentiss Tool and Supply Co
Arm 7911 Drive 7810 Head 8785 D. Drive P. 7815
Base 9063 Frame 9061 Table 8573 D. Frame P. 7692
Specials
Inspected Remarks

FIG. 7. SALES-CARD FORM—SIZE 4x6 INCHES

SEQUENCE CARD. RADIALS. 19341
Seq. No. 4
12 No. 6 Univ Heads. Shop No. 8785

Arms	Bases	Drives	Frames	Tables	D. Drives P.	D. Frame P.	Specials
9-7911	12-9063	8-7810	12-9061	12-8573	6-7815	7-7692	
3-8949		4-9062			6-9014	3-9017	

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FIG. 8. SEQUENCE-CARD FORM—SIZE 4x6 INCHES

THE MATERIAL LIST

THE PROGRESS CARD

This card, Fig. 6, deals with a unit as a whole. Its principal mission is to enable the manager to ascertain whether the order is receiving the intended attention, and, if not, in what department the work is being retarded. It is of assistance, also, in naming deliveries. The entries are made by the route clerk in whose custody the card is kept, filed according to its shop-order number.

The Sales Card

This card, Fig. 7, is used for recording the construction of every machine built. All entries are made by the route clerk, whose custody it never leaves. The size, style, machine number and shop-order number of the head unit are inscribed in ink, at the time of issuance of each new head-unit order, while the sales number, length of arm, style of drive and table, together with the name plate, are entered in pencil at the time the machine is sold; or, if it is to be erected for stock, at the time the assembling order is issued, in which event the spaces for the sales number and name plate are, of course, left blank. A pencil is used for these entries in order to provide for change of construction requested by the agent.

The balance of the card is filled out at the time of shipment, when all pencil notations are converted into ink. The shop-order numbers of the units are obtained from the tags in the unit cabinet, Fig. 10. The four blank lines at the bottom are for recording whatever additional information may be needed in order to duplicate the order at a future time. The reverse side of the card is divided into four columns of various widths for noting the sales number, date, shop-order number and description of such repairs as may be called for from time to time.

ASSEMBLING CARD. RADIALS.

Size No. 6 Style Full Universal
Arm 7 ft. Drive Gear Table Plain
Sales No. 1602 Assemb. No. 9900 Machine No. 18700
Name Plate Prentiss Tool and Supply Co.
Special Features
Erect 4 ft. with units:
Arm 7911 Drive 7810 Head 8785 D. Drive P. 7845
Base 9063 Frame 9061 Table 8573 D. Frame P. 7612
Together with Orders
Remarks

Fig. 9. Assembling-card Form—Size 4x6 Inches

The Sequence Card

The necessity for this card, Fig. 8, is much greater in one shop than another. To a concern operating under a single shop-order system, its value is infinitesimal, while to those whose line is as varied as ours, it is quite as essential as any other form described. Its face is used to record for ready reference the quantity and shop-order number of each unit that enters into the construction of a lot of machines as a whole. This effectually ties together every order that will be needed at about the same time, and henceforth enables the manager to deal with the work in the aggregate under a single sequence number.

On the reverse of the card are twelve columns. The first is headed "order" and is used for setting down, in the sequence in which the work is to be put through the

Lot No. 6877 Shop No. 9963 Sym. 3A27 Quan. 96 Dr'g. C1324
Head Main Bron-Rel

OPERATIONS	WORKMEN'S NAMES	No.	Rate	COMMENCED Mo.	Dy.	Hour	FINISHED Mo.	Dy.	Hour	TIME Regr.	Over
Reaming	Liedemeyer	23		10	15	9.15	10	17	4.30	26½	
Boring	Wieber	46		10	18	7.00	10	20	11.00	24	
Drilling	Otto	98		10	22	9.00	10	23	3.00	15½	

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Fig. 11. Lot-order Form—Size 5x8 Inches

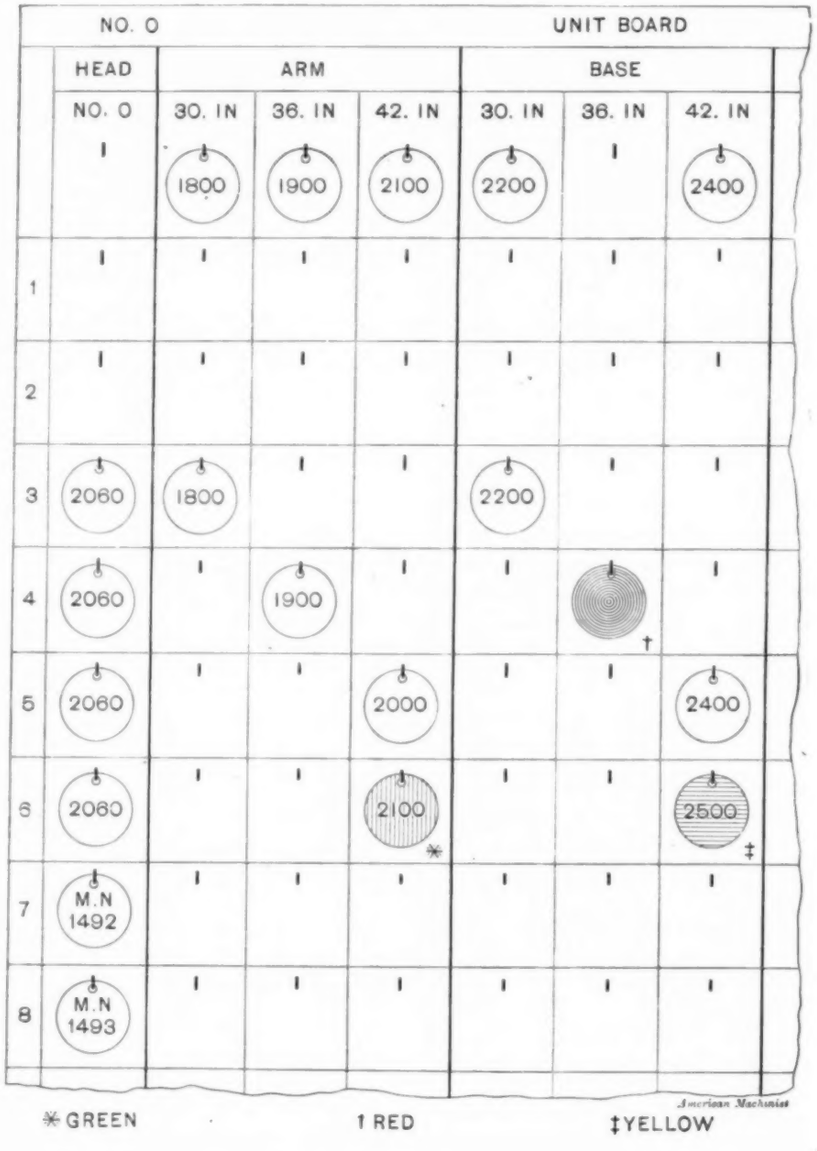

Fig. 10. Arrangement of Unit Cabinet

shop, the shop-order numbers for such of the above named units as their corresponding progress cards show have not been finished or previously sequenced. The remaining columns are headed "*A, B, C,*" etc., in representation of the various departments in the plant. They are used for recording the dates that each finishes its work on such of the opposing shop-order numbers as the absence of dashes indicates it has work to perform. This information is derived from the entries on the progress card, Fig. 6. A sequence card is issued by the route clerk with each new head-unit order, but all that he does at this time is to enter the quantity, size, name and shop-order number, and file it according to the latter. Here it remains until its shop-order number is sequenced on the manufacturing schedule, Fig. 16, when he makes the remaining entries, including the dashes, and refiles the card according to the sequence shown. The information for these remaining entries is derived from his progress card, Fig. 6, and the unit cabinet, Fig. 10.

The Assembling Card

An assembling card, Fig. 9, is issued for each machine to be erected. The route clerk enters the size, style and machine number at the time of writing out the order for the head unit, and then files the card according to "Size" and "Machine Number."

ROUTE CARD Shop No. 9963

For Head Bracket

Symbol 3A27 Drawing No. C.1324

Seq.	1	2	3	4	5	6	7	8	9
Dept.	A	C	B	E					
Jig No.	9227	9234	9230						
"									
"									
"									
"									

Remarks

American Machinist

FIG. 12. ROUTING-CARD FORM—SIZE 3x5 INCHES

As each machine is sold, he inscribes the length of arm, the style of drive and table, the sales number and name plate, together with a description of any special features that the order may specify, and sends the cards to the superintendent, who likewise files it according to size and machine number. Here it remains until such time as the superintendent receives from the route clerk a shop order specifying the style in which each of the machines is to be erected, when he returns to the route clerk all the cards he has for the lot.

The route clerk then enters on them the shop number on which the machines are to be assembled, the sequence in which the foreman is to erect them, and the shop-order number of each unit that is to enter into their construction. In busy times, when machines are usually sold long before the work reaches the erecting department, the shop-order numbers of the supplementary units may be obtained from the sales cards; but in such cases as a lot of machines is ready for assembling in advance of all of them being sold, the route clerk solicits instructions from the manager as to the style in which the unsold ones shall be erected. The route clerk next enters on the reverse of the cards, Fig. 15, the diameters of the drills to be used in testing the machines, together with the speeds and feeds at which each drill is to be operated. These data are obtained from master cards furnished by the manager.

The cards are then returned to the superintendent, who turns them over to the erecting foreman selected for the work. Here they are arranged according to the sequence noted by the route clerk, in a transparent frame hung so that they can be inspected by the members of his gang. As each machine is finished, the inspector subjects it to the test specified, extracts the corresponding card, records the result thereon, adds the date the test was made, the name of the gang boss who assembled it, signs his own name and sends the card to the route clerk who, after entering on his sales card the date the machine was inspected, files it according to its machine number and notifies the shipping clerk that the machine is at his disposal.

The card thus accomplishes 10 distinct objects. Besides giving the superintendent such information as he requires—both before and after the work reaches the erectors—it shows the erectors in what sequence the machines are wanted, of what units each is composed, what name plate is to be attached to each, and to what shop-order number their time should be charged. In addition, it tells the inspector to what test each machine is to be subjected, supplies a convenient means for recording said test, advises the route clerk of the date the machine was finished and serves as a permanent record.

The Unit Cabinet

This consists of a double row of sliding boards, ruled and provided with hooks, as shown in Fig. 10. It is used by both the manager and route clerk for ascertaining by means of tags just what units are in stock or course of manufacture, for which units it would be well to issue new shop orders, on what individual machine number a new lot of any supplementary units will first be used; on what units, if any, the work in the shop should be hurried; how many machines composed of a certain lot of heads have been sold, the exact style of every machine for which orders have been received; which machines, if any, are to be fitted with anything of a special nature; and how many machines of any particular lot have been shipped. It is also of great assistance in issuing the shop order for the final assembling of the machines, as, by the time the work on the units has advanced to this stage, orders may have been received for so many of the machines that the style of but few is left in question. These the manager can either make a shrewd guess about, or leave to be assembled on a future order. Another desirable feature which the unit cabinet possesses is that, no matter how often our agents ask us to furnish a machine in some style other than originally specified, no confusion is caused in our records.

It will thus appear that the cabinet is helpful in 10 distinct ways, and the only labor involved in keeping it up consists of the following operations: Each time the route clerk issues a shop order for a lot of heads, he stamps its number on as many white tags as there are units specified by the order, while on the reverse of these tags he stamps the consecutive numbers the machines will bear at the time of shipment; the tags are then hung in the column headed "Head," one on each hook, with the machine-number side exposed.

The tags for the other units are handled

Spindle Sym. 3A123

This stock should not be permitted to fall below 6 *pieces.*

P. O. No.	Ordered Date	Ordered Q	Received Date	Received Q	S	Issued Q	Issued Date	Shop Order	Lot Order
9652	1-8-10	75	2-3-10	50	50				
					2	48	1-8-10	8400	9600
			2-17-10	25	27				
					3	24		9000	9900
		75							

American Machinist

FIG. 13. STORES-CARD FORM—SIZE 6x9 INCHES

somewhat differently. If the order calls for twelve 42-inch arms, the route clerk stamps its shop-order number on one green tag and 11 white ones and hangs them, one outside of another with the green one last, on the fourth hook in the top row. This is repeated with each new unit order he issues. Then, as the machines are sold he reverses their head unit tags and places opposite each the tags for such other units as will enter into their construction. These, it will be understood, are taken from the top row of hooks.

Where a sales order calls for anything special in a unit, the special feature, together with the shop-order number on which it will be made, is noted on a yellow tag and the tag hung on the hook for the unit affected. The only other colored tag used is a red one. This symbolizes what additional units are required to fill the orders already received. They are not marked in any way, nor are they placed on the board until after the tags for the units on order are exhausted.

If the reader will now refer to the sample board shown in Fig. 10, I will explain how it is interpreted.

1. To ascertain how many machines are in course of manufacture on shop-order number 2060, note the figure opposite the last head-unit tag. Answer: 8.

REQUISITION

Purchase Order No. 9652 Symbol 30 123
Name Spindle
Quantity Wanted 75 Requisition Issued 1-6-10
Ordered from Maeda & Ruebmann
Date Ordered 1-8-10 Date Received 2-17-10
Total Cost Individual Cost
Remarks:
American Machinist

FIG. 14. REQUISITION FORM—SIZE 3x5 INCHES

2. To ascertain how many machines of this lot have been shipped, note the figure opposite the last vacant hook in the head-unit column. Answer: 2.

3. To ascertain how many machines of the lot have been sold, note the figure opposite the last head-unit tag that has its shop number exposed. Answer: 6.

4. To ascertain how many of the machines are unsold, subtract the figure opposite the last tag whose row is occupied by other tags, from the figure opposite the last head-unit tag on the board. Answer: 2.

5. To ascertain for what machine any new lot of units will have to be completed, look for green tags (*), then read machine number on reverse. Answer: 1491.

6. To ascertain what machines are to be fitted with special features, look for yellow tags (‡). Answer: 1491.

7. To ascertain what additional units will be required to fill orders on hand, look for red tags (†). Answer: One 36-inch base.

8. To ascertain in what units the stock is running low, inspect tags on top row.

9. To ascertain what units are in stock or course of manufacture, inspect tags in each column.

10. To ascertain the style of any particular machine, inspect the row of tags opposite its head unit.

THE LOT ORDER

While this form, Fig. 11, is used mainly for obtaining cost, it is made to serve several other purposes in course of transit. Its face requires no description further than to say that all time entries are made by the cost clerk after it reaches his department. The reverse side is ruled, part way, in columns headed: "Symbol," "Description of Material," "Date," "Quantity," "Purchase Order Number" and "Amount." Below these columns are four lines arranged thus:

Remarks: .....Material $.....
..... Hours $.....
..... Wages $.....
..... Cost $.....

The spaces at the right are filled out at such times only as the cost clerk is asked the cost of a certain piece. Following this are these instructions:

"THE ROUTE CLERK will issue a lot order for each piece that appears on the material list for the unit to be manufactured and will then send the former to the storekeeper.

"THE STOREKEEPER will file all lot orders according to their symbols, where they will remain until such time as the work for each is wanted in the shop, when he will fill out and attach a work tag, enter the date on the material card, and the weight, date and quantity on the lot order, draw a line through its symbol on the material list, send the work and corresponding route card to the department in which its material list indicates the first operation is to be performed, and return the lot order to the route clerk.

"THE ROUTE CLERK will then draw a line through its symbol on his material list, enter on his stores card the date such of the material as is purchased on the outside was issued, transcribe on the lot order its purchase order number, and send the lot orders to the cost clerk.

"THE COST CLERK will first enter in his prime-cost ledger the cost of the material issued on the lot order, after which he will file it according to its lot-order number and thereafter inscribe thereon whatever time the time slips indicate should be debited to it. He will also total the time consumed by each operation and record same on the comparative time cards, enter in his weekly time book the individual workman's time on all shop orders, and later post same in his prime-cost ledger."

TEST RECORD

This Machine was erected by John Herding
The Head was operated back and forth on the arm for 2 hours.
The Spindle was run at maximum speed for 2 hours with the arm in its lowest position, and for 1/2 hours with the arm in its highest position, without undue heating in any bearing.
The Base trammed 4 thousandths low at the left of the Spindle
" " " 2 " " " " back " " "
The Power Required to pull the arm with head at the end was pounds.
The Spring with a 3/4 inch drill and 20 thousandths feed was 1/2 of an inch.
" " " " 1 1/2 " " " " " " " " 3/64 " " "
" " " " 3 " " " " " " " " 1/16 " " "
Remarks:
Inspected by Thomas Green Date Nov. 1, 1910
American Machinist

FIG. 15. TEST-RECORD FORM—SIZE 4x6 INCHES

THE ROUTE CARD

The route card, Fig. 12, is used to pilot the elements that enter into each unit; i.e., is concerned about the individual pieces, only. Its functions, however, are twelve-fold: It informs the storekeeper in what sequence the material for different shop orders will be wanted, and to what department he should send the card on the receipt of same; it advises the foreman of that department that the material is ready for machining, it gives, in addition to the number of the drawing, the numbers of the jigs that are to be used in the work, thereby bringing into action such new ones as have

been designed; it supplies a convenient means for the foremen to classify their work according to the relative preference it should receive, the class of tool best suited to the operation to be performed and, when the work is assigned, the particular tool engaged on it; it also acts as a reminder to them to check their guide sheet when their portion of the work is completed, and shows to what department the card and work should be sent next. In addition, it shows the foreman of the assembling floor what pieces he has with which to proceed with his work. The lines at the bottom for "Remarks" are used by the foreman to communicate any improvements they think could be made in the method of handling the work, while the reverse of the card contains the following instructions:

"THE ROUTE CLERK will issue one of these cards with each lot order.

"THE STOREKEEPER will file the card in either one of two ways. If its Shop Order Number appears on the Sequence List, he will file it according to the sequence in which said list shows the work is to be put through the shop—otherwise he will file it according to the sequence of its Shop Order Number—i.e., place it in numerical order with the Route Cards for such other work as is also awaiting assignment. The Storekeeper will retain the card until such time only as the material therein specified shall have arrived, when he will send it to the foreman of the department indicated in column 1.

"THE FOREMAN will file the card according to its Shop Order Number, where it will remain until such time as this number appears on the Sequence List, when he will refile it in accordance with the sequence shown thereon. Here it will again rest until all work scheduled ahead of it shall have been assigned, when the foreman may file it according to the size or number of the tool best suited to the operation to be performed. As each job is finished the foreman will check his guide sheet and send the card to the foreman whom it shows is to perform the following operation."

THE STORES CARD

This card, Fig. 13, is used by the route clerk only. On it he keeps a record of all parts purchased on the outside; such as spindles, steel castings, ball bearings, etc. The first entry is made at the time of writing out the lot orders. This consists of noting in the "Issued" column the quantity of pieces needed to fill the order, of inscribing in the two following columns the shop and lot order numbers under which the work is to be manufactured, and, if the card indicates that more material should be ordered, of entering in the "Ordered" column the quantity specified on his requisition. The return of the requisition from the purchasing agent gives him the purchase order number, column 1, and the date, column 2; while the data for the "Received" column are obtained from a form called "Storeroom Receipts." The date in the "Issued" column is entered at the time the storekeeper returns the lot orders. The "S" column is for entering the quantity of pieces on hand after the receipt of each shipment or the issuance of each lot to the shop. The only other entries that have to be made on this form appertain to material issued on a "Stores Withdrawal Order," used for obtaining material to replace defective castings, spoiled work, etc.

THE REQUISITION

All requisitions for parts purchased on the outside, Fig. 14, are made in duplicate. They are issued by the route clerk whenever the "S" columns on his stores cards, Fig. 13, indicate that an additional quantity of material should be ordered. The initial work consists of entering the date, symbol, name and quantity; of transcribing on the stores cards the quantity specified on the requisition, of filing the original according to its date and symbol, and of sending the duplicate to the purchasing agent.

Here it is also filed according to date and symbol, where it remains until such time as the purchasing agent shall have issued his purchase order, when he enters on the requisition the purchase order number, the name of the firm to whom he is sending the order, together with its date, and returns the requisition to the route clerk.

The route clerk then enters on the original the information added by the purchasing agent, returns the duplicate to the latter, transcribes the purchase order number and date on his stores card, and files the requisition according to its purchase order number and symbol, as does the purchasing agent his copy.

Both copies now lie dormant until such time as the stores card shows that all the material has been received, when the route clerk dates his requisition and sends it to the purchasing agent who enters the cost on both, and files them according to symbol, one in his office and one in that of the cost clerk.

This course of procedure insures that the purchasing agent is advised at the earliest date possible of all new material that should be ordered, and that any undue delay on his part will be detected by the route clerk. It also enables the route clerk to ascertain quickly the purchase order number of any particular piece about which he may wish to inquire of the purchasing agent, and when, and in what quantity the material was ordered. In addition, it shows the purchasing agent what material he has still to order, permits of his finding instantly the requisition for any particular part about which some question may arise, supplies a convenient means of letting him know when the order has been filled, and acts thereafter as a ready reference for both himself and the cost clerk.

(To be Continued.)

An Extemporized Draw Stroke Shaper

BY OWEN LINLEY

We were making a cast-iron sleeve 8 inches long which had to have a keyway in it $\frac{5}{8}$ inch wide. The only tool that we had available for this was a shaper, and the cutter being rather wide, it persisted in chattering violently.

While watching the machine working, the Morton draw-stroker shaper came across my mind. I had never seen one of these machines but often thought there was something in the principle. It happened that this shaper had no quick return, so here was a chance to try the experiment.

I told the workman to turn the cutter round in the bar and set the cut in from the front. The effect was magical, the cutter working without the slightest sign of chattering and taking good, heavy cuts. Nothing else had been altered in the machine but the direction of the cut.

I was so pleased with the result of this experiment that I had a tool holder improvised to swing in the opposite direction by bolting two cheeks on the sides of the clapper box, thus bringing the pin that the tool box hung on further forward.

Two stops projected from the lower part of the cheeks and prevented the cut pulling the tool box out from between them and, thus equipped, we tried it on other work with every success.

The probable reason why it works so well is that the ram is in tension while the knee is drawn up solid against the body of the machine.

What most people interested in aëroplane development look upon as a decided step forward is the construction material used in the new Esnault-Pelterie monoplane, the exhibit of which at the recent Paris Aëronautical Exhibition attracted considerable attention. In this machine the framework, including that for the lateral and vertical rudders, is entirely of steel tubing. On the lower longitudinal frame member is mounted the lever for operating the wing warping, the lever being on ball bearings and the connection up to the driver's hand being by means of a stout steel column. Without being unnecessarily heavy there is as great a margin of safety as in the best built automobile steering gear. This machine is looked upon by some as the forerunner of an "all steel" flying machine.

System in the Tool Room

By Lucian Haas *

Methods used in designing and keeping track of jigs and fixtures in some of the large manufacturing plants.

Standard parts for use in making jigs and fixtures, operation sheets, records and how they are used.

A suggestion for shops which are getting along in the old way.

It is, of course, essential that the tool-designing department be run systematically and the following is a simple method in operation by some of our largest manufacturing companies.

The part is carefully drawn full size and the jig laid out. The drawing is then inspected by the chief tool designer and after meeting his approval the sketch is made as follows:

a. A prospective view is made as shown in Fig. 1, sketches being made by the use of three sheets of carbon paper underneath. One of these is a tissue paper so that blueprints can be made from it. The other carbon copy goes to the toolmaker and the original copy is retained for the file in the tool-designing department.

b. The next operation is to make a pencil and one carbon copy only, of all detail parts to be finished on milling machine, shaper, lathe, etc. All forging or special parts are then placed again on separate sheets as shown in Figs. 2, 3, 4, 5 and 6.

c. All of these sheets are given the tool sketch number and entered in the tool record. Then everything is checked and the number of the operation for which the tool is made is placed on the perspective sheet.

d. A blueprint is made from the tissue copy of the perspective sketch and sent to the tool store or tool crib so that the man in charge always has a means of knowing just what the tool looks like. This is extremely convenient in case a tool has been accidentally put in the wrong bin or misplaced, as the sketch gives a much better clue than any description possibly could.

e. Every sketch must be O. K'd. by the chief tool designer, the tool-room foreman, and the superintendent, after which they can be sent to the cost department for orders.

f. When the orders are received they are given a coat of shellac and then turned over to the tool room and the tool made.

*Chief tool designer, Thomas Motor Company, Buffalo, N. Y.

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Tool Designing Departments Accessories

The numbering of the tool record book

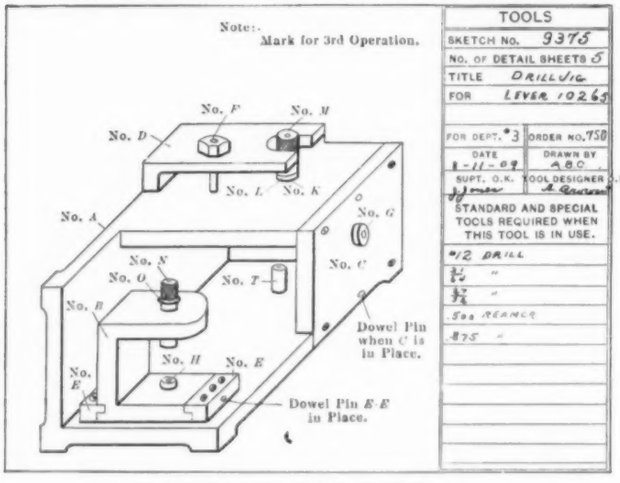


FIG. 1. SKETCH OF COMPLETE JIG

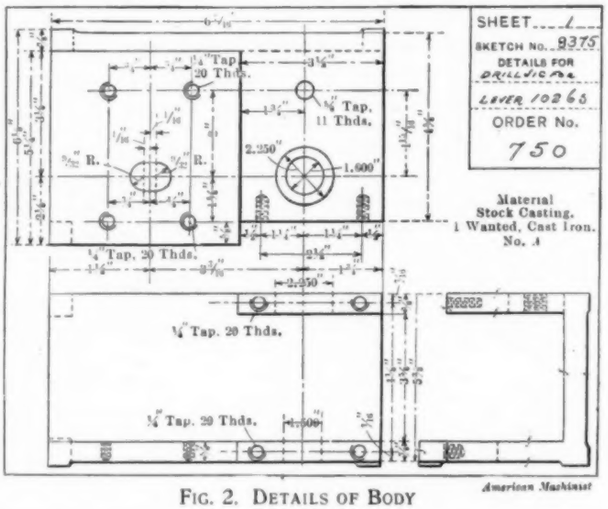


FIG. 2. DETAILS OF BODY

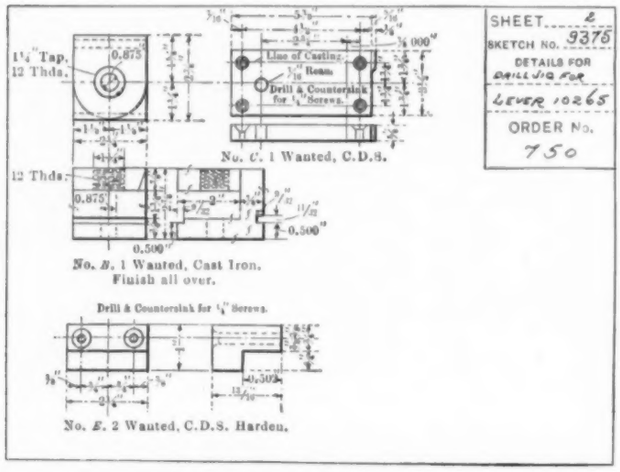


FIG. 3. THE PLATE AND SLIDE

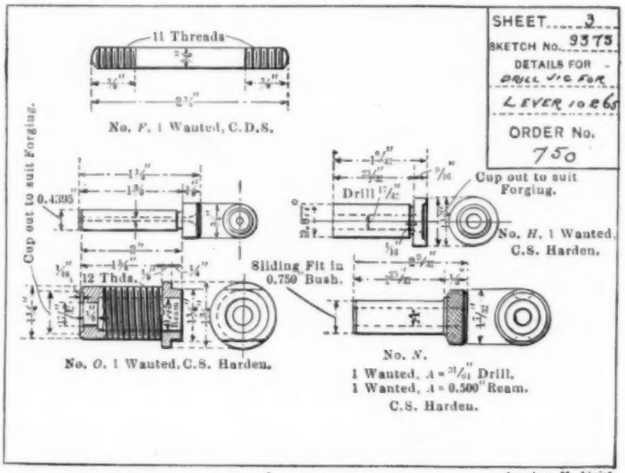


FIG. 4. PARTS TURNED AND GROUND

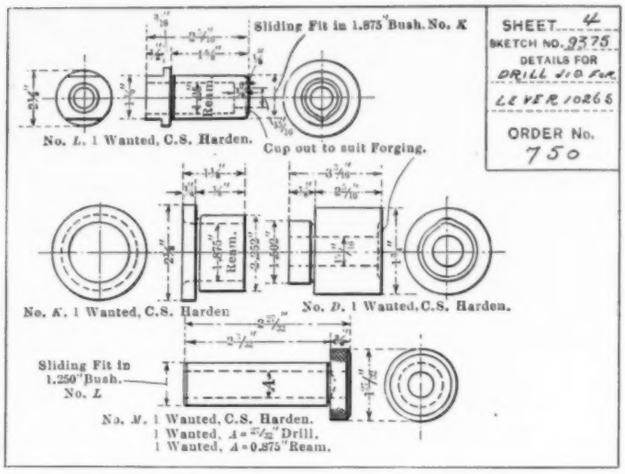

Sliding Fit in 1.875" Bush. No. K
Ream.
No. L. 1 Wanted, C.S. Harden.
Cup out to suit Forging.
SHEET 4
SKETCH NO. 9375
DETAILS FOR
DRILL JIG FOR
LEVER 10265
ORDER No.
750
No. K. 1 Wanted, C.S. Harden
No. D. 1 Wanted, C.S. Harden.
Sliding Fit in 1.250" Bush. No. L
No. M. 1 Wanted, C.S. Harden.
1 Wanted, A = 27/32" Drill.
1 Wanted, A = 0.875" Ream.

FIG. 5. THE HARDENED BUSHINGS

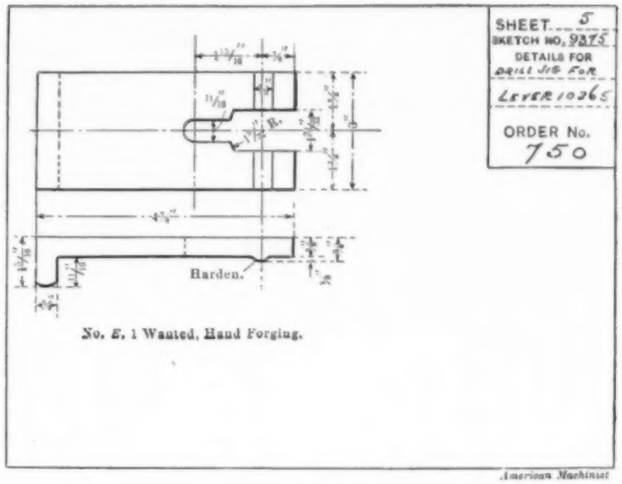


FIG. 6. A FORGING

FIG. 7. TOOL-RECORD BOOK

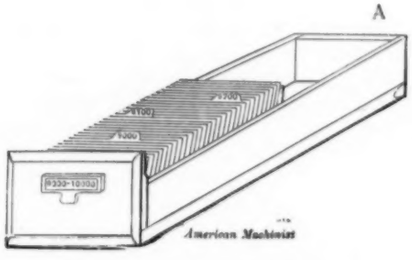


FIG. 8. CARD REFERENCE FILE

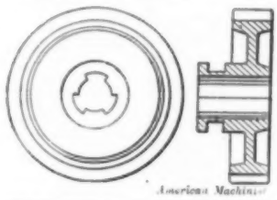
LEVER	10265
NAME OF TOOL	SK. NO.
Drill Jig	9375
Plug Gage	9376
Pilot counterbore	9377
Gage	9378

FIG. 9. REFERENCE FILE CARD.

OPERATION SHEET.

CHEMICAL ANALYSIS.

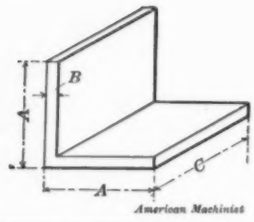
3½% nickel steel.
C.—0.18 to 0.28%.
Mn.—0.50 to 0.90%.
Ni —3.00 to 3.75%.
P.—0.030 or less.
S.—0.035 or less.



DRAW. NO.—26,735.
NAME.—Low Speed Gear.
DATE.—Sept. 30, 1910.
SUPERINTENDENT.—O. K.
GEN. FOREMAN.—O. K.
TOOL DESIGNER.—O. K.

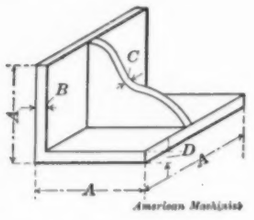
Oper. No.	Name of Operation.	Name of Machine Planned For.	Send to Dept.	Name of Tool.	Sketch No. of Tool.	Remarks.
1.	Anneal—put in furnace and heat to 1400°. Leave in and cool down with furnace for about 10 hours.		Hardening Dept.			
2.	Rough grind		Rough grinding.			
3.	Bore and ream "A," rough turn and face "E" and form "F."	Potter & Johnston.		Standard tools.		
				Form tools and bars.	9,200	
4.	Face "H" and form "G."	Potter & Johnston.		Form tool and bar.	9,201	
				Snap gage.	9,202	
				Test plate.	9,203	
5.	Rough cut teeth "C."	Gould & Eberhardt.		Collars.	9,204	
				Backing plates.	9,205	
6.	Anneal—put in furnace and heat to 1400°. Leave in and cool down with furnace for about 10 hours.		Hardening Dept.			
7.	Broach hole "A" to size	LaPointe broach.		Roughing broach.	9,206	
				Finishing broach.	9,207	
				Plug gage.	9,208	
8.	File off burs left by broaching operation.		Bench.			
9.	Finish turn and face "H" and "E," also groove "B" to size.	Engine lathe.		Taper arbor and bush.	9,209	
				Formed lathe tool.	9,210	
10.	Inspect for gear cutter.		Inspection.			
11.	Finish cut teeth "C."	Fellows gear shaper.		Test plate.	9,211	
				Collars.	9,212	
12.	Round mill teeth "C."	Tooth rounding.		Adaptors.	9,213	
13.	Bur and file teeth "C."		Bench.			
14.	Inspect for hardening.		Inspection.			
15.	Pack harden, allow to cool in pot, reheat to 1375°–1425° F. and quench in oil. Inspect for hardness.		Hardening Dept.			
16.	Wash in hot soda-water tank until all oil, etc., is removed, then wire brush		Rough grinding.			
17.	Broach hole "A" to size if necessary	Hydraulic press.		Finishing broach.	9,214	
				Plug gage.	9,215	
				Limit gage for teeth.	9,216	
18.	Send to inspection department for final inspection		Inspection Dept.	Plug gage.	9,217	
				Test plate.	9,218	
				Arbor.	9,219	
				Scleroscope reading =		
19.	Send to gear department to be lapped.		Gear Dept.	Lapping fixture.	9,220	

FIG. 10. OPERATION SHEET.



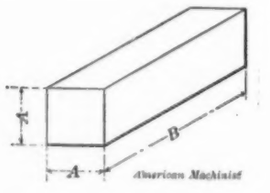
A	B	C
3″		6″
4″		6″
6″	1	6″
6″	1½	12″
8″	1	8″
8″	1½	12″
10″	1½	10″
12″	1½	12″
14½″	1½	7″
13″	1½	12″

FIG. 11. STANDARD ANGLE.



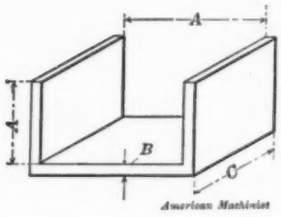
A	B	C	D
6″	1″		1″
6″	1½″		1″
8″	1″		1″
12″	1½″		1″

FIG. 12. STANDARD ANGLE.



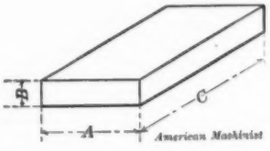
A	B	A	B
1″	6″	3″	12″
1½″	10″	4″	12″
2″	10″	5″	12″
2½″	12″		

FIG. 16. STANDARD SQUARE.



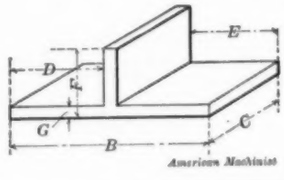
A	B	C
1¼″		6″
1½″		8″
2″	1	10″
3″		12″
4″	1	14″
5″	1½	14″
6″	1½	20″
7″	1½	20″

FIG. 13. STANDARD CHANNEL.



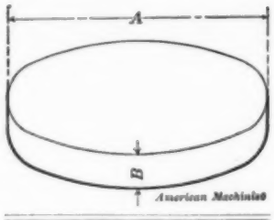
A	B	C
3″	1¼″	6″
3½″	2″	7″
4″	2½″	8″
4″	3″	10″
3½″	2½″	15½″
4½″	2½″	9″
7″	2½″	12″
9″	5″	18″

FIG. 18. STANDARD BRICK.



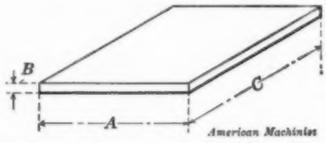
A	B	C	D	E	F	G
2½″	10½″	5½″	2A″	5½″	6½″	1A″
2½″	14½″	6½″	6½	6½	7½″	1½

FIG. 15. STANDARD TEE.



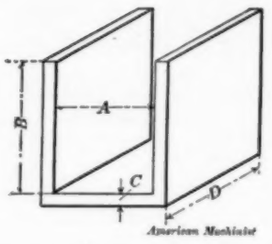
A	B
8	1
10	1½
12	2
14½	1½
16	2½
22	1

FIG. 19. STANDARD ROUND.



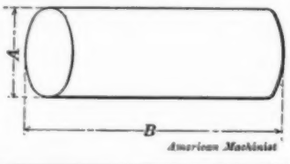
A	B	C
3″	1″	10″
3″	1″	22″
4″	1″	12″
4″	1″	24″
5″	1½″	12″
6″	1″	12″
6″	1½″	34″
7″	1½″	48″
8″	1″	12″
9″	1½″	14″
10″	1½″	24″
12″	1½″	24″
12″	1½″	12″
13″	1½″	28″
14″	1″	14″
16″	1½″	16″
18″	1″	18″
20″	1½″	20″

FIG. 17. STANDARD PLATE



A	B	C	D
1¼″	3″		6″
1½″	4″	1½″	14″
1½″	4″		8″
2″	5″	1″	12″
2½″	6″	1½″	12″
3″	7″	1½″	12″
4″	8″	1″	14″
5″	7″	1½″	13″
6½″	4″	1½″	7″
6½″	5″	1″	8″
7″	6″	1½″	6″

FIG. 14. STANDARD CHANNEL.



A	B
¾	10
1	4
1½	8
2	6
2½	10
3	8
4	10
5	10
6	12

FIG. 20. STANDARD BAR.

and tool sketches can be done with a duplicate numbering stamp.

The tool sketches are made on an ordinary 8x10-inch scratch pad and a rubber stamp for the heading of the perspective sheet can be used as shown on the sketch in Fig. 1 and for the detail sheets as shown in Fig. 2.

In conjunction with this, a series of rubber stamps will be found very useful and helps to give the sketch a neat appearance in case any note such as VOID, RUSH, HOLD-UP, TEMPORARY, etc., is desired to be added to it.

In conjunction with the sketching, a good drafting machine is very necessary to assist the draftsman in producing quick work.

With the above system it is remarkable how quickly a sketch can be turned over to the toolmaker and as it often happens a temporary jig, arbor, pin gage or some other tool which is wanted in a hurry does not require a layout but simply a sketch giving the toolmaker the necessary dimensions and that important point of having a record of the tool.

Tool Record and Operation Sheets

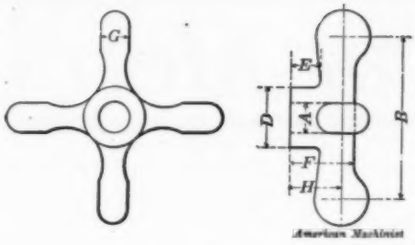
The operation that each piece of work undergoes should be decided in this department and is then entered upon the operation sheet as shown in Fig. 10. The sketch is stamped accordingly with the sketch number taken from the tool record and the number of the operation taken from the operation sheet.

The tool record consists of a well made book with the numbers running consecutively as shown in Fig. 7. The sketch gets its number from this book, after which the tool is entered on a card as shown in Fig. 9 and this card is placed in a reference file as shown in Fig. 8.

The tool record simply acts as a check in taking out numbers and prevents a number being taken out twice.

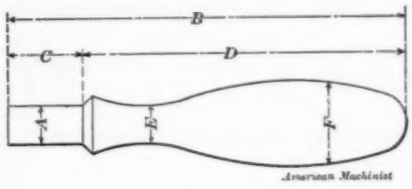
The reference card is filed under the part number and is consulted in case one wishes to know what tools are made up for that particular part.

There are several styles of operation sheets or cards and these are generally made to suit the condition governing the factory. Fig. 10 is an example of an operation sheet which can be used to advantage almost under all conditions. It is made of tracing cloth and the operation, etc., are written upon it with a soft pencil, the reason for doing this being to quickly take care of any changes or additions which may arise and the sheet being made of tracing cloth facilitates the making of an indefinite number of prints



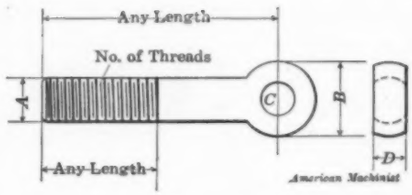
A	B	C	D	E	F	G	H
1″	1½″	3½″	⅝″	⅝″	⅝″	⅝″	⅝″
1¼″	1¾″	3½″	⅝″	⅝″	⅝″	⅝″	⅝″
1½″	2″	4″	⅝″	⅝″	⅝″	⅝″	⅝″
1¾″	2½″	4½″	⅝″	1″	⅝″	⅝″	⅝″

MALLEABLE IRON CROSS JIG KNOBS.



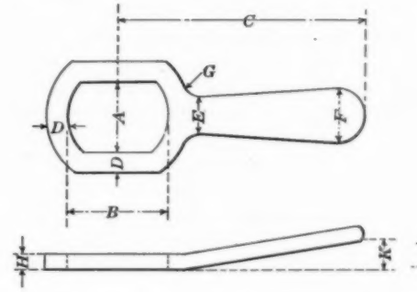
A		B	C	D	E	F
Rough Diam.	Finish Diam.					
¾″	⅞″	2½″	⅝″	1½″	⅝″	1″
⅞″	1″	3″	⅝″	2″	⅝″	1¼″
1″	1¼″	3″	⅝″	2½″	⅝″	1½″
1¼″	1½″	4″	⅝″	3″	⅝″	1½″
1½″	1¾″	5″	1″	3½″	⅝″	1½″
1¾″	2″	5½″	1″	4½″	⅝″	1½″

JIG HANDLES—STRAIGHT.



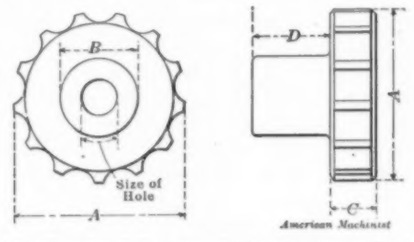
A	No. of Threads.	Form of Threads.	B	C	D
¼″	20	U.U.S.	⅜″	⅜″	⅜″
⅜″	18	U.U.S.	⅜″	⅜″	⅜″
⅜″	16	U.U.S.	⅜″	⅜″	⅜″
⅜″	14	U.U.S.	⅜″	⅜″	⅜″
⅜″	13	U.U.S.	⅜″	⅜″	⅜″
⅜″	12	U.U.S.	1″	⅜″	⅜″
⅜″	11	U.U.S.	1″	1″	⅜″
⅜″	10	U.U.S.	1″	1″	⅜″
⅜″	9	U.U.S.	1″	1″	⅜″
1″	8	U.U.S.	1″	1″	1″

EYE BOLT ENDS.



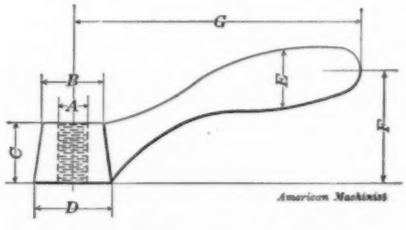
	Single Handle.								Double Handle.								
A	B	C	D	E	F	G	H	K	A	B	C	D	E	F	G	H	K
¾″	1¼″	3½″	⅝″	⅝″	⅝″	⅝″	⅝″	⅝″	2″	2″	9″	⅝″	1″	1″	⅝″	⅝″	⅝″
1″	1½″	3½″	⅝″	⅝″	⅝″	⅝″	⅝″	⅝″	2½″	2½″	9″	⅝″	1″	1″	⅝″	⅝″	⅝″
1¼″	1¾″	4″	⅝″	⅝″	1″	⅝″	⅝″	⅝″	2½″	3″	10″	⅝″	1″	1″	⅝″	⅝″	⅝″
1½″	2½″	4½″	⅝″	⅝″	1″	⅝″	⅝″	⅝″	3″	3½″	10″	⅝″	1″	1″	⅝″	⅝″	⅝″

SINGLE AND DOUBLED HANDLED JIG WRENCHES.



Size of Hole.	A	B	C	D
¼″	1¼″	⅜″	⅜″	⅜″
⅜″	1½″	⅜″	⅜″	⅜″
⅜″	1¾″	⅜″	⅜″	⅜″
⅜″	2″	⅜″	⅜″	⅜″
⅜″	2″	1″	⅜″	⅜″
⅜″	2″	1″	1″	⅜″
⅜″	2½″	1″	1″	⅜″
⅜″	2½″	1″	1″	⅜″

MALLEABLE IRON JIG KNOBS.



A	B	C	B	E	F	G
1″–24	1″	1″	1″	1″	1⅛″	2½″
⅞″–18	1″	1″	1″	1″	1⅛″	2½″
⅞″–16	1″	1″	1″	1″	1⅛″	2½″
⅞″–14	1″	1″	1″	1″	1⅛″	3½″
⅞″–13	1″	1″	1″	1″	1⅛″	3½″
⅞″–12	1″	1″	1¼″	1″	1″	4½″
⅞″–11	1″	1″	1¼″	1″	1″	4½″
⅞″–10	1″	1″	1¼″	1″	1″	4½″

JIG HANDLES—BENT.

which can be distributed among the different departments without any delay.

When the tool is completed it is then tried out with the part and sent to the tool inspector to be checked up with the sketch and, after receiving his O. K., is sent to the tool crib or store, ready for use.

A tool designer or maker should have a set of standard tables for his reference which insure the producing of a jig and its component parts all in proportion. It also reduces the cost of the jig and helps delivery of same. For example, let us consider a tool designer having a set of standard angles, channels, round plate and round stock, bricks, plates and square stock, as given in the accompanying tables. The proportion and range of sizes have been compiled for jig making only and it is surprising how many jigs or fixtures can be built up from them..

As an example of the way these standard castings can be used refer to Fig. 1, which shows quite an elaborate drill jig. This is made up of practically two standard channels, a plate and standard bushings. For operating these bushings the standard wrenches can be used as shown. The large channel *A* has half of one side cut out and both the sides planed down to receive the plate *C*, which ties the sides of the channel together and also carries a drill bushing as shown.

A smaller channel *B* is planed to slide under the gibs *E E* and allows the bushings to be adjusted as desired with reference to those carried in *A*. Almost innumerable combinations can be made in this way and this also gives all examples of the perspective sketching in connection with this system.

Industrial Education Society's Work for 1911

The National Society for the Promotion of Industrial Education has recently issued a little pamphlet setting forth the aims and activities of the society and outlining its work for 1911. This pamphlet describes the need for industrial education to meet modern conditions of manufacturing and to enable the United States to compete in the markets of the world; to provide that kind of training under conditions of specialization which used to be given by apprenticeship; as well as to open to boys and girls a wide range of employment through giving them a broad familiarity with industrial processes and to adapt public education to the real needs of American youth, nine-tenths of whom take up, directly or indirectly, industrial careers.

The society is now entering the fifth year of its existence and a prospectus may be had upon application to the secretary, 20 West 44th street, New York.

Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room. A letter good enough to print will be paid for. The value is in the idea—not the length of the letter

A Makeshift Hacksaw—Cutting a Gear on a Vertical Miller

Fig. 1 shows a rig up we used to saw cut the webs of a crank shaft 21-inch throw. There was no particular hurry about the job but it was necessary to do it with as little expense as possible. The crank shaft was leveled on packing and steadied with struts on the floor in front of an old lathe which was seldom used. A plate *A* held in the chuck had a bolt screwed in tightly and this served as a crank pin to move the saw frame. The frame was made up of stock pipe and fittings, ¾ in. being the size used. A T-piece formed the rod end to work on the pin *A*. The plug *B* and stud *C* were slit and drilled to receive the ends of the saw, which was strained and locked by the nuts *D D*. To steady the front end of the saw frame two boards *E* were nailed to a joist overhead and to the floor at the bottom, just sufficient room being left to allow the projecting part of the frame to work freely between them. After starting a cut a weight was attached to the frame at *F* to feed the saw. This arrangement did the job satisfactorily and at a very low cost. When finished the fittings were returned to stock. The only outlay incurred was that for the 17-inch saw blades, and, except for an occasional glance to see the cut was running straight, the only labor needed was for the setting.

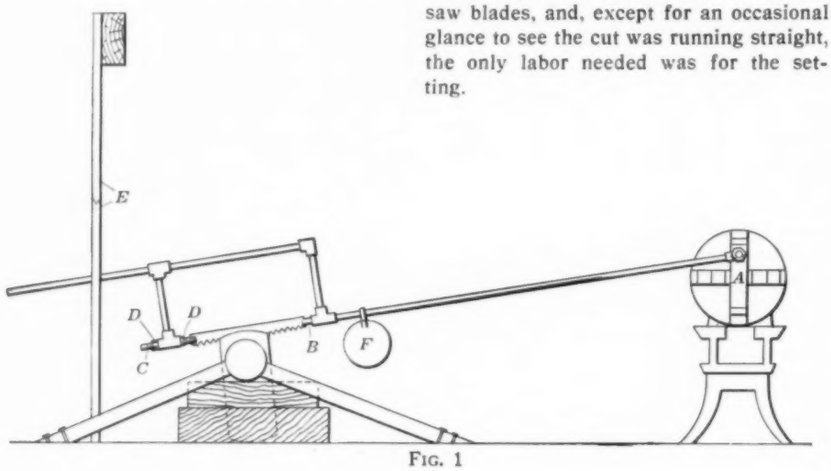


FIG. 1

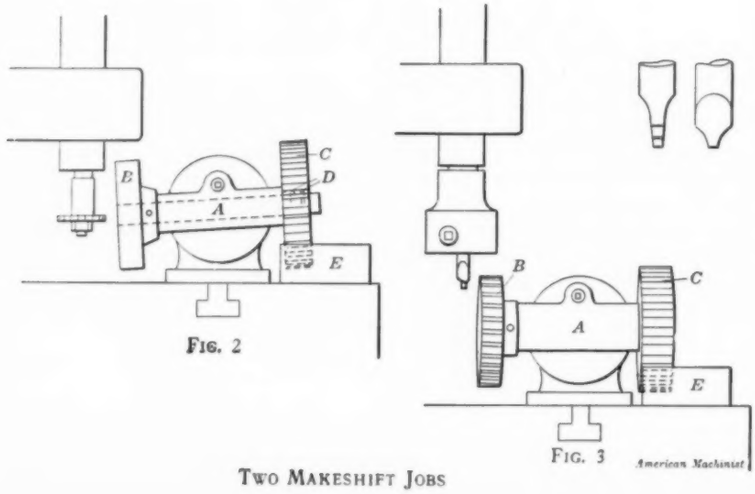


FIG. 2 FIG. 3

TWO MAKESHIFT JOBS

CUTTING A GEAR ON A VERTICAL MILLER

Another job on which a little scheming rendered good service occurred when overhauling a motor truck. The fans and circulating pump were driven by belt off a spindle geared to the 2 to 1 shaft, and a new 21-tooth gear was wanted for this spindle. The teeth were inclined at an angle of 5 degrees with the axis. Gear cutting is out of our regular line but we decided to do this job with what equipment we had. Our milling department is limited to one machine, a vertical. We have, however, one of those small cutter grinders provided with a universal swiveling head, and we have also several lathes with cut change gears. From these we picked out one with 42 teeth and with a hole the same size as that in the universal head, ¾ inch. By a stroke of luck this was also the size of the hole in the gear blank so that a piece of ¾ bright drawn steel served for a mandrel and completed our temporary dividing head.

Fig. 2 shows the job ready for the first operation on the mill; gashing the blank with a 5/32-inch slotting cutter. The head *A* is set and clamped at an angle of 5 degrees. The bronze blank *B* is secured to the spindle with a taper pin and the gear wheel *C* fits tightly on the pins *D*. These pins are driven into holes in the spindle and filed up to serve as keys. A planed packing strip *E* acts as a gage or stop for dividing, one of the teeth of *C* being brought down onto it before clamping the spindle for the first cut, and alternate teeth in succession for the following cuts, thus giving 21 divisions in the blank *B*.

To finish the teeth a cutter was made as shown in Fig. 3. A piece of round tool steel was turned on the end to fit the teeth on one of the engaging gears on the motor, and then ground flat. The edges were backed off and nicked and the cutter hardened. The universal head was then clamped with the spindle horizontal but at an angle of 5 degrees with the cross slide of the mill table. The cutter was held in a Westcott chuck which we have fitted to the mill spindle, and run at a high speed. It would have removed the remaining metal quite easily in one cut but to insure against springing the teeth we went round twice. The packing strip was used as before for dividing.

The gear produced proved perfectly satisfactory in use, the teeth being short it did not matter that they were not truly spiral. The form of cutter shown is very useful when an odd gear is wanted. It is at least as easy to make as a flycutter, and for equal cutting speeds works faster,

as no time is lost between cuts. We also find it extremely handy to have the drill chuck on the mill spindle. Fish-tail cutters for keyways or odd cutters such as that described can be made of any suitable size of steel and used without turning the shank to any special size.

London, England. B. L.

Broaching and Slotting Done on the Arbor Press

The lever arbor-press is a machine-shop utility which met with instant favor upon its introduction a few years ago and quickly supplanted the old block and sledge-hammer method of mandrel driving. That it is by no means a one-purpose article, however, can be shown by the accompanying line drawings, which illustrate its use as a keyseater and a punch press.

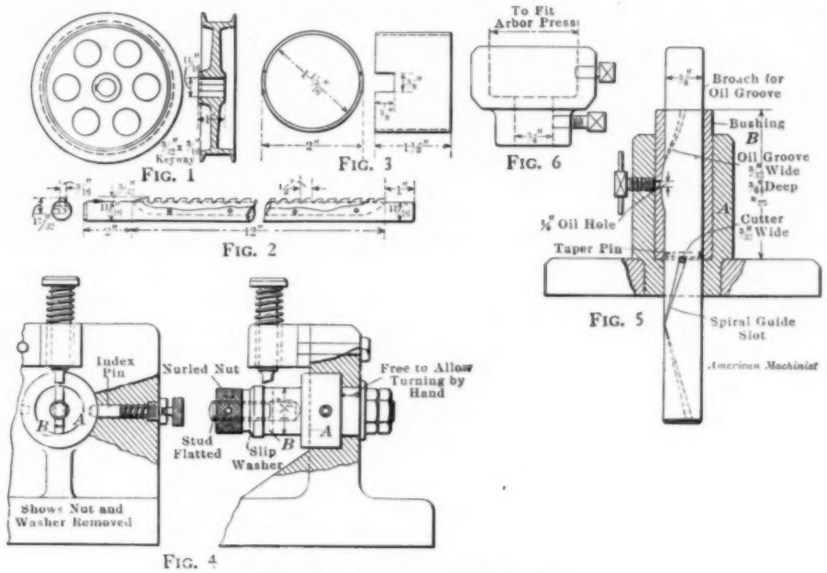


FIG. 1. FIG. 3 FIG. 6

FIG. 2

FIG. 4 FIG. 5

WORK DONE ON THE ARBOR PRESS

Figs. 1 and 3 and the brass bushing *B* in Fig. 5 illustrate three of a number of pieces we are producing economically by this method; other pieces will be readily suggested to anyone contending with a limited shop capacity.

Fig. 1 is a small cast-iron pulley. The broach shown in Fig. 2, the teeth of which taper from 0.003 to 0.093 inch, is pressed through and the keyways cut at the rate of one a minute. We also cut a 1/16x1/8-inch keyway in a steel gear with the same size hole, using two broaches and the average time is under two minutes including all handling. A cast-iron plate, counterbored to fit the pulley hub, is provided to rest the work upon and no clamping is required.

Fig. 2 is a steel shell, bored and turned to size. At first thought the cutting of the 3/8x3/8-inch slot is a milling job. In this case, an overcrowded milling department led to the construction of the jig shown in Fig. 4. The work mandrel *A* has a 3/8-inch slot milled across the end as shown at *B*, and the center drilled and tapped for the 5/8-inch stud which is screwed tight and flatted to fit the slip washer. The work being fastened by means of the nurled nut, the slots are cut successively, the work mandrel being held and located by the index pin. The spiral spring under the head of the punch forces the latter up after each stroke.

Fig. 5 is a jig for cutting an oil groove in the brass bushing *B*. This bushing has a 1/8-inch oil hole midway in its length and a spiral oil groove 3/32 inch wide and 3/32 wide and 3/64 inch deep, half round in cross-section.

The spiral advances a half turn in the length of the bushing and must "split" the oil hole.

The bushing is located by the set screw in *A* entering the oil hole. The cutter bar has a spiral guide slot milled on the lower end, which slot engages a hardened pin in *A*, not shown in the cut but located a quarter turn from the set screw.

The press spindle is provided with a chuck shown in Fig. 6 in which the cutter bar is held.

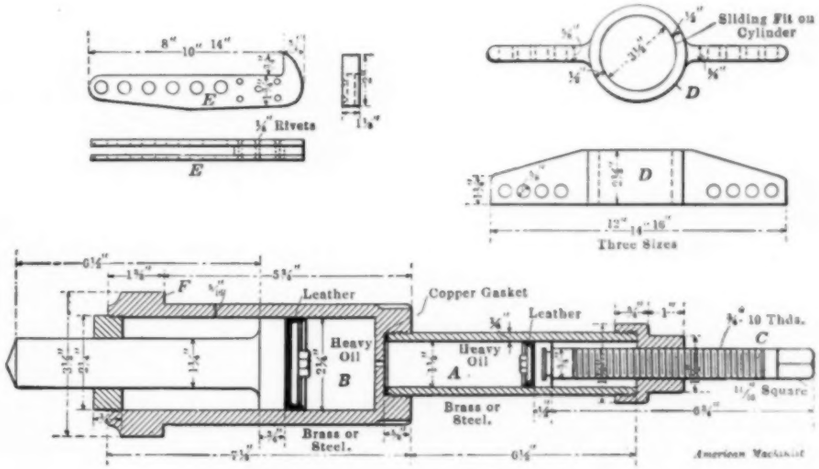
These are simple tools, their use is highly profitable, and we are constantly adding to the array of parts we are producing by similar devices.

Cleveland, Ohio. PAUL CAMPBELL.

A Hydraulic Wheel Puller

The line cut shows a hydraulic wheel puller which I designed. The small cylinder *A* is screwed into the end of the large ram cylinder *B* as shown. The piston of the small cylinder is mounted on the end of the screw *C*. Heavy oil is used in the cylinders in the place of water or spirits. The yoke *D* fits over the large cylinder, the strain being taken by the shoulder *F*. The hooks *E* are adjustable for length and are also adjustable, for width of hub, on the yoke *D*. The combined forces obtained by the use of a small cylinder and a screw are very great, the puller having been tested to 48 tons.

Clinton, Ia. H. F. KILLEAN.



A HYDRAULIC WHEEL PULLER

Static Electricity as an Obstruction

A manufacturer using some measuring and wrapping machines for putting up powders, found that sometimes the paper, which was fed into the folder from a roll, would slide forward only a little way and then stick, while the rest of the paper piled up on the back of the machine. For a long time he could not find what caught the front edge of the paper.

One day one of the machines would not feed the paper at all without catching so he took off the folding mechanism to see if the paper would feed forward without it. The paper would advance a little way and then fly back against a piece of tin which was next to where the folder belonged. By holding pieces of

paper near the machine he found that they were attracted to all the adjacent parts, which seemed to prove that it undoubtedly was charged with static electricity. The trouble finally was overcome by substituting fiber guides for the paper in place of the original brass ones.

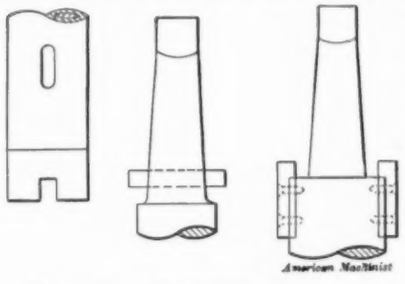
Something similar occurred in a local bleachery, where cloth was brought up through the floor to the top of a room and passed over a large roll. Some days the cloth would be so attracted to the roll that it would cling and wind around it instead of merely passing over it. This condition was remedied by hanging wet cloths at each end of the roll and as close to the moving cloth as possible.

Waltham, Mass. ARTHUR N. KING.

Preventing Breakage of Drill Tangs

Having charge of the tools for large high-speed drilling and tapping and being troubled with the breaking of tangs, I now fit all tools with keys, which fit driving slots in the spindle noses.

A ⅜-inch slot is milled ½ inch deep in the center of the end of the drill-press spindle in line with the drift hole. The



PREVENTING BREAKAGE OF TANGS

keys in the tools are also in line with the thin way of the tang, so that they can be used in any spindle.

Rochester, N. Y. J. W. F.

An Improved Micrometer

The object of this improvement is to enable more accurate reading of the micrometer, so as to readily disclose at a glance how much above or below a given size a piece may be after this micrometer has been set to a given size. The pin *A* slides in a guide as shown in Fig. 1. It is connected to the pointer *B* which indicates on the dial *C*, a spring normally holding the pointer at the low point. When the piece to be measured is placed in position the stem is screwed down pressing the piece against pin *A* until the pointer moves to zero. The reading is then taken, and when the next piece is to be measured to the same size, it is placed between the pin *A* and the stem and the pointer will move from zero up or down according to whether such piece is thicker or thinner than the standard. The scale indicates the difference in thousandths or ten thousandths, or whatever is desired.

D is an adjusting screw and slot whereby the scale may be adjusted to compensate for the variation in the threads of the micrometer.

In Fig. 2 is shown the lever *B* connected by suitable gearing with the pin *A* and with the lever *B'* and the pointer *B*. The operation will be the same, only the

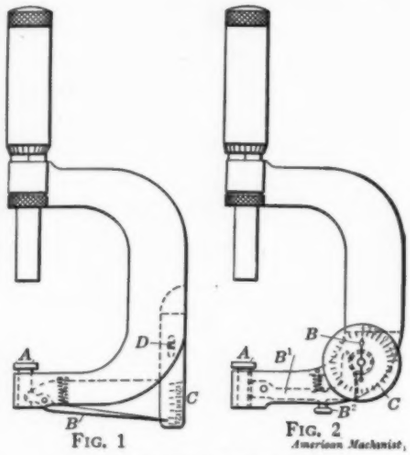


FIG. 1 FIG. 2

AN IMPROVED MICROMETER

scale or dial in this case may be more conveniently made finer than in the other case as for ten-thousandths or above.

The button at *B''* enables the lever *B'* to be operated. In either case if the piece to be inserted should be thicker than the standard, the part *B'* or *B* may be used to draw down the pin to let the piece in readily, and then when the pin is released it will move against the piece and indicate on the dial the amount that the piece may be over or under the standard size.

With this improvement the ratchet used on the top of micrometers may be dispensed with, or it could be used in conjunction with the device.

New York. MORRIS HIMOFF.

Facing Washers and Boring an Emery Wheel

I have taken great interest in reading the AMERICAN MACHINIST, and have received a lot of information for everyday use from the section devoted to letters from practical men, and these letters have also aroused an interest in my work which formerly seemed to be lacking.

The other day I had a number of steel collars to make out of a 3-inch bar of cold-rolled steel. The collars were ¾-inch face, 3 inches diameter, 1½-inch bore. After boring the hole the face is turned smooth and polished, then the stock is cut off a trifle over the required width. I used the scheme shown in Fig. 1 to face off the other side. A piece of cast iron *a* 3¼ inches diameter was gripped in the chuck, turned off and the end faced, bored and tapped for the ⅝-inch cap screw *D*. *C* is a taper sleeve ⅝-inch bore, which holds the collar *b* in place while facing and polishing.

Some time ago a customer brought in an emery wheel, 2-inch face, which he wanted rebored. The lead bushing he said, was a cinch, but still the hole was ⅜ inch too small for the arbor. Fig. 2 shows what I used to do the job. *A* is an Armstrong

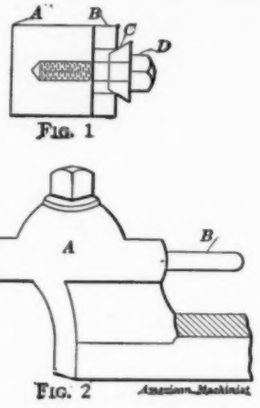


FIG. 1

FIG. 2

THE ARBOR AND THE TOOL

boring tool, *B* a piece of ¾-inch cold-rolled steel which at one end is bored and tapped for a 5/16-inch cap screw *D*, which holds the emery-wheel dresser cutters *C*. Running the lathe at high speed, after chucking the emery wheel, this was used the same as an ordinary boring tool, enlarging the hole ⅜ inch in a very short time.

Sheboygan, Wis. E. BESTE.

Making a Radius Forming Tool

The method of producing a radius forming tool for lathe, planer or other machine, to be described here is, as far as the writer's experience goes, quite novel. Of the ordinary means usually adopted, one is that of broadening the piece of tool steel at the cutting end and holding it in a vise in a drill press at an angle suitable to give clearance and boring it out with a drill or reamer to the radius required. This procedure is found more or less unsatisfactory, owing to the fact that the drill meets the surface at a right angle, unless provision is made for this when forging. Another way is to strap the piece from which the tool is to be made onto the face plate of a lathe, and with the slide set at an angle to give clearance, bore out to the diameter of the radius required. This is unsatisfactory because after being ground once or twice there is a perceptible increase in the size of form produced when cutting which, however, can be overcome if the piece be tilted on the face plate to give clearance and bored parallel instead of taper.

The method recommended as being preferable to either of the foregoing, consists in laying the prepared piece of tool steel on its side and clamping it thus

onto the top of the slide rest; then with a boring bar and cutter running between the centers, cutting away to the desired radius by traversing the carriage, the clearance obviously being imparted by swinging the clamped tool sufficiently out of square. If a radius of a standard diameter is wanted, and a reamer or end mill is available to run between centers in place of the boring bar, the job becomes quite simple.

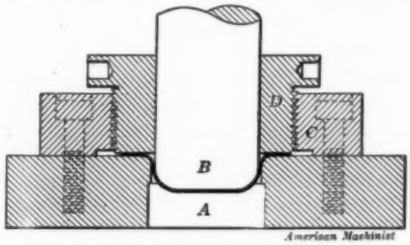
B. N. BIRMINGHAM.

Drawing Brass Shells

In recent issues a prominent subject of discussion was the various methods of drawing brass shells. While the methods described were exhaustive there is a method that I have devised, and herewith describe, not with any idea of criticizing the methods previously advanced.

I have a variety of drawn shell work to get out, but in comparatively small quantities, therefore simplicity and cheapness of the tools are necessary. This precludes the use of any complication which would be entailed by the use of spring pressure pads in a single-action press not suited for them.

Our usual design of tool consisted of a die and guide plate, bored a sliding



DRAWING BRASS SHELLS

fit for the punch, affixed to but separated from each other by a thin distance plate a little thicker than the blank being drawn. The distance plate was bored for the blank and opened on one side to allow insertion of the blank between the die and guide plate. While the distance plate was left thick enough to allow easy insertion of the blanks, it had to be thin enough to prevent wrinkling of the blanks. Owing to the blanks being slightly buckled at times the necessary alterations of the tools led to trouble through the wrinkling causing the bottoms of the shells to break out.

To one of the existing tools I made the alterations as illustrated. I had the guide plate *C* bored larger and threaded for a screw collar *D* which in turn was bored a sliding fit for the drawing punch *B*. Round the top of the collar ¼ inch spanner holes were drilled. The thread was 12 per inch Whitworth although in the drawing it is shown a buttress, which is better able to stand the pressure of the blank than the Whitworth form. The distance plate was dispensed with, the guide plate being recessed on its under side, and opened on one side, at the same time it was threaded to insure concentricity.

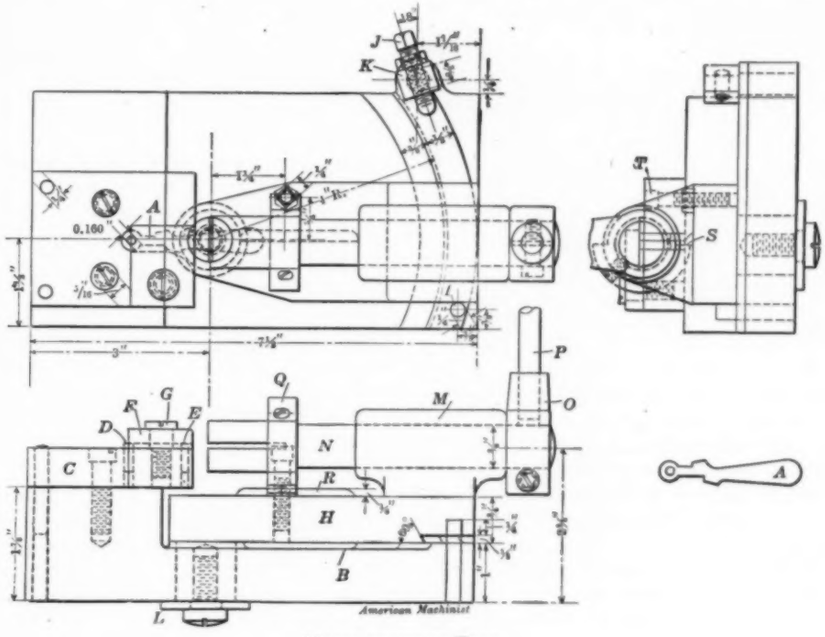
In operation the collar is loosened for inserting the blank and then tightened down upon the blank, the amount of pressure exerted to a certain extent being governed by the length of spanner used.

With a brass blank 2⅞ inches diameter the particular tool cited draws a shell 1 5/16 inches diameter and 1 5/16 inches deep, the metal used being soft brass 3/64 inch thick. This I think must be admitted to be good, considering that the percentage of breakages is very small indeed.

London, England. W. MADDISON.

A Hand Bending Tool

An interesting hand-bending fixture for making a quarter-turn in the piece *A*, is illustrated and described in the following article. The piece is shown alone in the lower right-hand corner, and in position in the view of the tool that occupies the upper left-hand corner.



HAND-BENDING TOOL

The base casting *B* carries the machine-steel pack-hardened block *C*, which forms the rest for the piece. The piece is located on pin *D* and against pin *E*, and the swinging block *F* is turned into position, fitting closely over the work. The block *F* swings on the shoulder screw *G*.

Two pieces are bent in this fixture, one straight and one offset at an angle. The straight piece is bent with the swinging base *H* of machine steel located against the pin *I*, and for the angular piece the base is swung around and located against the adjustable screw *J*, which is secured to the base casting *B* in the block *K*. The swinging piece is pivoted on the shoulder screw *L*.

The bearing *M* supports the shaft *N*, which is slotted in one end to receive the work and the other end carries the collar *O* holding the handle *P*, by which the shaft is turned. The movement of the shaft is limited to an arc of 90 degrees by means of the collar *Q*, which is secured to the shaft by a set screw. The fin *R* on the base *H* engages the face *S* on the collar when the slot in the shaft is horizontal, and the adjustable screw *T* engages the face *U*, when the slot is turned vertical, thus confining the shaft to a rotary movement of 90 degrees.

Altoona, Penn. DESIGNER.

Hardening Tool Steel

Anyone that can harden tool steel successfully knows the importance of having even heats and all the other matters of value pertaining to the same, so it is unnecessary for me to say anything regarding the preliminary work in the hardening of the steel, but before placing the tool in the furnace or fire, sprinkle some common table salt on it and when the salt melts and runs, similar to a welding flux, that is the required heat; plunge it in good clean water, using your good judgment as you have always done in cooling tools. When cool, the tool will be hard and free from scale and you can gamble your month's pay that it won't be cracked; draw to the proper temperature and you have something that will give you service. The writer has hardened hundreds of tools in this manner, covering a period of twelve years, and believe me, it's *the* way.

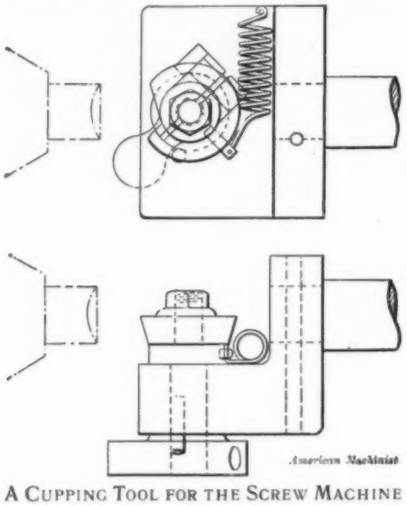
Tools hardened in this manner, especially forming tools, will hold 50 per cent. better than if salt is not used.

Akron, Ohio. S. A. LECKIE.

A Cupping Tool for the Screw Machine

Among the large family of special screw-machine tools, the cupping tool here illustrated is well worthy of recognition. The cutter is circular and is set with the cutting edge on the center of the work. The diameter of the cutter determines the radius of the cup. It will be seen that the cutter is sharpened the same as the ordinary circular tool for screw-machine work, thus keeping the dimensions of the cup the same until the tool is worn out. The 15-degree angle to cutter is for clearance.

The cutter is positioned on the post and held secure by the nut and washer. On



A CUPPING TOOL FOR THE SCREW MACHINE

the under side of the cutter post is a clamp which can be adjusted to get the spring tension required to retain the post against the stop pin.

The tool is held in the turret and is brought up to proper relation with work and held there while the cross slide carries forward and revolves the cutter. By coming in contact with the clamp in the bottom of the cutter post, the cutter swings on its center and cups the work. The cutter is returned by the spring and the tool then withdrawn.

Philadelphia, Penn. C. A. T.

A Blueprint Washing Tank

There are many small manufacturing concerns that have occasion to make blueprints in moderate quantities, and the best method of handling this work is always a problem, especially if room is scarce, and initial expense an item.

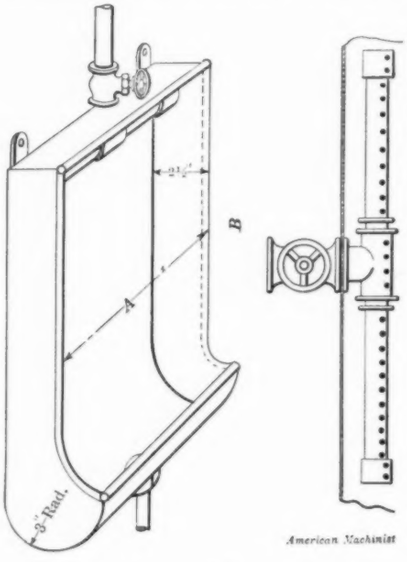
The tank for washing blueprints here described, has been used by me on various occasions, and should appeal to anyone, on account of its cheapness, efficiency and compactness.

The tank is designed to hang on the wall in any convenient location, suspended by the two straps shown in the cut, and is made of heavy galvanized iron, with a ¼-inch stiffening wire rolled around the front.

The water supply enters from above through a ¾-inch globe valve, and the stream is distributed over the back of the tank, by means of a T-shaped sprinkler, the construction of which is readily seen by inspection of the detail view of same.

When assembling the piping, the horizontal pieces and the ¾-inch T are located so that the streams of water play against the back of the tank and the flange of the globe valve and the flange of the T serve to hold the sprinkler in position in the tank. A short drain pipe or a brass union may be soldered into the lower portion of the trough, and the outlet piped to any convenient point.

The width and hight of the tank will, of course, depend on the size of the larg-



THE TANK AND THE SPRINKLER PIPE

est blueprint that it will be necessary to wash, but I have used this construction for washing prints 48x56 inches with perfect success, and see no reason why larger sizes cannot be used equally well.

To wash the prints, the water is first turned on and after the back of the tank is wet all over the print is placed against it with the sensitive side of the paper outward, and so that the upper edge of the paper will come above the point where the small streams of water hit the back of the tank. The water will then flow down over the print and it will adhere to the back at once, and remain there until removed, to be hung up and dried.

Detroit, Mich. ARON LAWRENCE.

A Suggester in Place of the Suggestion Box

Every superintendent or works manager is, or should be, aware of the assistance which can be rendered by suggestions of the shop mechanic. The idea of the suggestion box and compensation for valuable suggestions was a good one, but it stopped just short of success.

Getting suggestions from the men should be considered from the same standpoint as that of getting new business. What uptodate concern thinks of getting orders without special representatives or traveling salesmen? The mechanic has valuable ideas, and the right kind of a man on the job to solicit these ideas, and to aid the mechanic to develop and get his scheme down to a practical basis gets ideas for the firm.

The man must be one well suited for such a position. He must be popular, and able to gain the confidence of the men. He must thoroughly understand production, and the designing of jigs, tools and fixtures, in order to aid the mechanic in the development of his ideas, for the reason that few mechanics are able to properly construct or make designs. The idea comes in the rough and must be worked out in practical shape.

This special representative should spend enough time in the shop every day to visit and talk with the men about their work, and to receive suggestions. He can make himself valuable by helping to adjust complaints, and we all know there are enough of them. In fact, a man in his position should be able to straighten out a good many kinks, which otherwise might develop into more serious trouble.

He must be exceedingly careful not to take up more of the mechanic's time than the suggestions are worth. He should always carry a notebook, in which to enter suggestions. This should be done in the presence of the mechanic who makes the suggestion, and dated, day and hour. In fact, it is necessary to carry everything to extremes to inspire confidence.

At the end of the month, a committee should be appointed, made up of the special representative, the superintendent, perhaps a couple of reliable foremen and a representative of the men. This committee should award the prizes.

The right man for this job is hard to find. He must possess a great deal of tact, be a good designer, a good fellow among the men, yet able to command the respect of both men and employer. He must fully realize that it is his place to give credit for ideas, not to receive it. His credit comes from the success of the scheme.

When such a proceeding is started, the employer should be sure of his man, for once a failure, it means many times the effort to start again. In fact, the main thing is to be absolutely square with the mechanic, and to possess the ability to bring out the ideas and develop them.

In some shops, such a man would be up against a mighty hard job, because of the constant endeavor of some foremen to gain recognition at the expense of the mechanic, as there are always some who will cause an endless amount of trouble in this way. But, again, it is a case where the right man in the right place can make himself invaluable.

Batavia, N. Y. B. W. CHURCH.

Discussion of Previous Question

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers

Gear Tooth Standards

In an article on page 1171, Volume 33, Part 2, Mr. Logue makes a number of statements and implications of such a character as to give, I believe, an entirely wrong impression to the reader who takes what he says as authoratative. This article is in the nature of a direct attack on the present established system of gearing. Some sweeping assertions are made regarding the strength of tooth, proportions of surface in contact, and modification of tooth surface from the true involute. Furthermore, what Mr. Logue says would lead us to feel that he considers that the present system of gearing is necessarily bad, because its refinements have not been made public and because he admittedly does not understand it.

Judging from Mr. Logue's article it is, in his opinion, a very simple matter to overthrow a system of gearing which has been developed through years of experience in dealing with and overcoming practical difficulties, and to substitute other systems therefor. In bringing forward these new systems Mr. Logue expatiates on the particular needs of rolling mills, etc. I have no issue to raise with Mr. Logue regarding the advantage of using special forms of gear teeth for rolling mills and other similar places where coarser pitches than are ordinarily cut with rotary cutters are used or in any place where strength is required, even at the sacrifice of quiet running. I believe it is also of advantage to use special forms of gear teeth in many other places, as, for example, for certain gears used in printing presses, where the best results are obtained by using a very small pressure angle, and especially long teeth.

I call to mind a case where a rack-and-pinion drive was used for the table of a special machine requiring extreme smoothness of motion. There were waves in the work, even though the rack and pinion were cut and adjusted with the greatest care. This method of driving was on the point of being abandoned and other methods involving a considerable outlay tried, when the matter was put in the hands of Oscar J. Beale, of the Brown & Sharpe Company, to decide what to do. He recommended that a pinion be made with the teeth all addendum, the pitch line being at the roots of the teeth, in order that the action might be entirely such as to draw the table down, eliminating any tendency to a lifting action. This was tried and proved a complete cure for the difficulty, illustrating that there is more to the question of gearing than some who are ready to propose a panacea for all its ills would have us believe. We do not feel that any extreme condition should form the basis for a system to meet the average needs, or that any advantage in a comparatively limited field, such as for rolling mills, should determine the system to the detriment of the great mass of gears finer than 1 pitch used on general machinery. Neither, as Mr. Gabriel says at page 716, Volume 33, Part 2, should the method of producing the gear be given undue weight as against improved interchangeability or more quiet running. Neither should the use of a system for cast-tooth gears or bevel gears requiring templets, etc., have a deciding influence.

Mr. Logue says that the supremacy of the generated bevel gear over the cut bevel gear is proof of the superiority of the theoretical spur-gear tooth over that which is modified. This reasoning is fallacious, as it is well known that a bevel gear cannot be correctly cut with a rotary cutter, while a spur gear can.

The reasons given by Mr. Logue for abandoning the Brown & Sharpe system, that it sacrifices a greater part of the tooth surface, and that the modifying of the true involute results in an irregular impulse, are also fallacious. The Brown & Sharpe system neither unduly sacrifices the tooth surface nor does it give an irregular impulse. Mr. Logue might be answered as Cuvier answered a student who defined a crab as a red fish than ran backward. Cuvier said, "A crab is neither red, nor is it a fish, nor does it run backward; otherwise your definition is correct."

The principles upon which the Brown & Sharpe system is based are such that contact could be had the full length of the tooth if desired, and the only reason for not so making it is to provide for the ordinary conditions of use. The easing off of the points is made just as little as experience teaches will be desirable for working conditions.

Mr. Logue asks, "What is going to happen when the tooth is a little worn?" Mr. Logue might be answered in Yankee fashion by asking him the question what would happen if the tooth were cut off at the point of actual contact, as recommended by him? At the first sign of wear or undue load the corners of the teeth of such gears would tend to gouge into the mating gear, an objectionable feature avoided by the present system, where wear tends to increase the bearing surface and where there is no gouging action.

The Modified Involute

Regarding the matter of the Brown & Sharpe modified involute, it is evident that if it gave an irregular impulse it would be fatal to quiet running, because at high speed it would produce the equivalent of a great number of minute hammer blows, and would increase the noise instead of lessening it. That the gears made with the tooth of the Brown & Sharpe system have given the best results for quiet running, is pointed out by Mr. Vernon where, in his discussion of the gear-tooth question at the joint meeting of the British and American Engineering Societies in Birmingham last summer, after referring to extensive tests made by his firm, he said: "It is now well known that the gears which gave the quietest results in running were those on which an empirical correction of the tooth form had been made."

Again Mr. Logue says, "The very secrecy which surrounds the Brown & Sharpe system has been the cause of its own undoing," and "is enough to kill any system, no matter how desirable." In a former discussion of the subject, I pointed out that even if the modifications of tooth form to give the best running gears were made public, it would be of doubtful advantage, as far as the cutter user is concerned, as it would not be economical for him to make his own cutters, and it is doubtful whether if he attempted it, satisfactory interchangeability would result. The very fact that the Brown & Sharpe system, with all the burden which Mr. Logue tells us rests upon it, is still very much alive, indicates that it must have virtues and advantages as yet undiscovered by him.

Mr. Logue points out as a serious failing that a pair of gears cut with cutters exactly right for a given number of teeth, did not give contact for more than two-thirds the depth. Assuming that this is a correct statement of the case, it would mean that one-sixth of the working face of tooth is eased off at the point to allow for the teeth to satisfactorily come into action when the gears are new. The working surface would be materially in-

creased as the gears wore, as it must be remembered that the clearance is not gouged away so as to be the equivalent of a shorter tooth; neither is it a rounding of the corner of the tooth, as advocated by Mr. Logue, but it is an extremely gradual easing off which is almost imperceptible. It must be remembered also that other teeth are constantly coming into action before the first have separated and that, with conditions of high speed and undue load as well as when wear has occurred on the tooth surface, or where there is faulty alinement or cutting of the gears, or where there are variations due to hardening either the cutter or the gear, this relieved portion of the tooth proves of decided advantage; an advantage which would be entirely lost if the tooth were shortened, unless for the short tooth also the corners were eased off. Cutters for 20 degrees pressure angle with short teeth, as regularly made by Brown & Sharpe, provide for the easing off of the teeth of the gears at the points, it being a matter of experience that the resulting advantages more than offset any loss, read or imaginary, from thus further shortening the tooth contact.

As a grand climax of condemnation, it is pointed out by Mr. Logue that a gear cut with a cutter designed for an exact number of teeth, will not run satisfactorily with the pinion cut with a cutter designed to be one of a series. The fact that cutters made for an exact number of teeth are not tied to the series having a limited number of cutters for the entire range, makes it possible to employ a system in making these cutters exact, such as will produce satisfactory gears to meet the most exacting requirements.

Mr. Logue concludes his article by suggesting the adoption of two new systems, and it is evident that he is ready to urge the adoption of these two systems even though they will not interchange with each other, and are thus open to his own caustic criticism when he says that lack of interchangeability "doesn't say much for the system in vogue."

As cutter manufacturers it might seem to be a good policy for Brown & Sharpe to accept the new standards proposed by Mr. Logue, and urge their adoption, because such a change would mean not only the necessity for the users of cutters to lay in a new stock made to suit the new standards, but instead of eight cutters for each pitch being satisfactory for a set to cut from a 12-tooth pinion to a rack, a larger number would be required, and in cases requiring greater accuracy where now half numbers of cutters are supplied making a set of 15 cutters, a greater number still would be required. All this might be very well for the cutter manufacturer, but how about the user? Even if the proposed systems were otherwise as good, this would be a serious objection to their adoption.

There is a tendency to forget that there are practical limiting conditions which must have consideration in order to reduce theories to successful practice. One reason why the English-speaking races have excelled in the development of the mechanic arts is because they have let hard, common sense and actual working conditions modify the theoretical and adapt it to actual needs. It is not believed that any system based on any theory whatever will come into use, but that manufacturers will strive to so modify it and "tune it up" as to obtain the the best possible results for their customers, and it is believed that those that do obtain such results will receive the support of the users of gears, any theories to the contrary notwithstanding.

LUTHER D. BURLINGAME.

Chief Draftsman Brown & Sharpe Manufacturing Company, Providence, R. I.

Choosing a Value for "E" in the Spring Formula

On page 147, George F. Summers gave an interesting article, describing a method of testing springs to obtain the torsional coëfficient of elasticity of the wire, so as to know what value of this to apply in the Begtrup spring formula, in designing a new spring. In all modesty, that is exactly what I used to do in designing springs for air-compressor valves for a well known pneumatic-machinery firm, and I am glad to find out that the idea was a good one.

In our case, every standard spring for any purpose whatever, was represented by a tagged sample hung in a special cabinet in the drawing room, and these sample springs were of the greatest assistance. If one did not think it worth while to calculate a new spring, a glance through this cabinet of samples, each spring upon its separate hook, would give a man something which he could "guess would be about right." Then again, if accuracy was desired, a similar spring would be selected and weighed out by Mr. Summer's method, and the value of *"E"* found for the Begtrup formulas. Remarkably close results were thus obtained, as was proved by weighing up some of the new springs when completed, and comparing their deflection under a given load, with what they originally had been expected to give.

There is one remark in Mr. Summer's article which has set me thinking. It is: "Care must be taken to subtract the actual weight of the spring from each reading." This refers to his method of testing large springs, his procedure being to rest the large, heavy spring upon a platform scale and tighten up on side rods bearing between the upper end of the spring and the stationary framework of the scale. His idea in considering the weight of the spring itself comes from the fact that, even when no outside compression force is applied, the weight of the spring itself would put an initial reading upon the scale. In the case of the large spring shown in Fig. 2, this weight easily might be 45 to 50 pounds.

Now, the question is: Should this total weight be subtracted from the readings, or should half of it be subtracted, or how should it be treated? Is it not a fact that the weight of the spring material is itself bearing down and causing an initial compression of the spring; and is not the spring shorter when standing on end, due to this weight, than it would be if lying down and perfectly free? This is undoubtedly true, but it does not seem right to consider this weight acting in the same way as the outside, applied, compressing force, because the bottom coil would support the entire weight of the spring; the middle coil, only half the weight; and the top coil, none at all.

Except in an unusually long "soft" spring, this initial weight of the material might be but a small part of the total compressing force, but it is easy to imagine a case where it might be a serious consideration. In such a case, I think that the true way to apply the formulas would be to determine the "free" length of the spring when lying, uncompressed, upon its side; then, when standing on end, its length should be determined before adding any outside weight; finally, applying some compressing weight or force, again determine the length under these conditions. Now, in applying these results to the Begtrup or other formulas, the total "deflection" always should be measured, it seems to me, from the original free length of the spring when lying on its side. But just how much of the weight of the spring itself to consider as assisting the total compressive force, in applying the formulas, is not at all clear to me. The trick probably could be worked out nicely by calculus, but I have forgotten most of what I once knew in that line, and it would be nearer to practice to use the data obtained by the weighing process, in one way or another (counting all, or half, or none of the weight, as might seem best), trusting to the similarity of the sample to the desired new spring to give the results wanted.

This necessitates having your sample test spring not greatly different from the new one wanted; but this might not be a great hardship, for, unless the particular machine requiring the spring has been built before, there will be many more points about which to guess than the spring alone.

The only questions I wish to raise are: Is Mr. Summers correct in his remark, and if not, what should we do in the case of a long, soft spring of considerable weight, when we have no sample from which to figure? It is well to consider

also, that the longer the spring the softer it will be and the greater its relative weight, so that the greater the error will be from both these causes.

New York City. R. S. BAYARD.

Automobile Engine Proportions

A. G. Kessler and G. W. Lewis have done an exceptionally good work in compiling data of automobile-engine proportions, as there has been rather a scarcity of anything in this line previously.

Before I ask any questions, or make any criticism of the article, I wish to state that my experience in this line consists of operating a 10-horsepower, two-cycle, two-cylinder motor for the last four years. I am not a technical graduate, and so may not be able to follow the article in the proper way, but I have made a hobby of the theoretical engine for the past eight years, and have designed a number of motors (which have never been built) solely for my own amusement. With this apology for presuming to discuss the work of men who probably are much better informed on the subject, I will get down to the troubles.

The particular cause of difficulty to me is the use of large constants, which have to be added to, or subtracted from, the result of that part of a formula which is derived directly by multiplication; from the cylinder diameter, or such other part as it may depend upon.

In the fourth section of this article appearing on page 864, Volume 33, Part 2, the diameter of water pipes is given for cylinders of 3-, 4- and 5-inch diameters; as that is the only place where I find any information as to the size of cylinders from which the formulas were derived, I have felt at liberty to use these sizes in demonstrating some of the formulas given.

The first formula which attracts attention is that for ratio of stroke to bore, given on page 485, Volume 33, Part 2, as $L = 1.43\,D - 1.62$ *inches*. For a 3-inch cylinder this gives $3 \times 1.43 - 1.62 = 2.67$ *inches*. For a 5-inch cylinder it gives $5 \times 1.43 - 1.62 = 5.53$ *inches*. The constant, 1.62 *inches*, spoils the formula, and it is difficult to see why the average could not have been obtained and given in a simple formula which would dispense with any constant, and thus make it an accurate average.

The use, or nonuse of this particular case is of no importance, however, as each designer has his own ideas of the proper ratio, my opinion being rather extreme; that is, $L = 1.5\,D$. The only reason I can see for the short stroke is that of cheapness and, possibly, a slight saving in weight. The mechanical efficiency of the long stroke would be considerably higher, and it is safe to say that the volumetric efficiency would be proportionately increased.

The next case of difficulty is the formula for piston-pin diameters, given on page 487 as

$$D_{wp} = 0.34\,D - 0.53 \textit{ inch}.$$

The diameter of the hole in pin is given as

$$D_{wpi} = 0.572\,D_{wp}.$$

For a 3-inch cylinder, these give

$$D_{wp} = 0.34 \times 3 - 0.53 = 0.49 \textit{ inch}.$$

$$D_{wpi} = 0.572 \times 0.49 = 0.28 \textit{ inch}.$$

Cross-sectional area would then equal $0.49^2 \times 0.7854 - 28^2 \times 0.7854 = 0.127$ square inches. For a 5-inch cylinder we have

$$D_{wp} = 0.34 \times 5 - 0.53 = 1.17 \textit{ inch}.$$

$$D_{wpi} = 0.572 \times 1.17 = 0.67 \textit{ inch}.$$

Cross-sectional area would then be $1.17^2 \times 0.7854 - 0.67^2 \times 0.7854 = 0.723$ square inch. Area of 3-inch cylinder $= 3^2 \times 0.7854 = 7.07$ square inches. Area of 5-inch cylinder $= 5^2 \times 0.7854 = 19.64$ square inches.

The pin for a 3-inch cylinder would then have a cross-sectional area equal to $\frac{0.127}{7.07}$ or 0.018 of the cylinder area, while the pin for a 5-inch cylinder would have a cross-sectional area equal to $\frac{0.723}{19.64}$ or 0.0368 of the cylinder area, which would be more than twice the shearing strength of the pin in the 3-inch cylinder, in proportion to the work it had to do.

$$L_{cp} = 3\,D - 1\tfrac{1}{4} \textit{ inches}.$$

For 3-inch cylinder, $3 \times 3 - 1\frac{1}{4} = -2\frac{1}{4}$ inches; for 4-inch cylinder, $3 \times 4 - 1\frac{1}{4} = \frac{3}{4}$ inch; for 5-inch cylinder, $3 \times 5 - 1\frac{1}{4} = 3\frac{3}{4}$ inches.

This is the worst formula of the series, as the only sizes which come anywhere near right would be for cylinder diameters from $4\frac{1}{2}$ to 5 inches, and, it will be noted, there is an increase in length of 3 inches for every inch increase in cylinder diameter.

On page 577 another formula for crank-pin diameter is given:

$$0.53\,D - \tfrac{1}{8} \textit{ inch} = D_{cp}.$$

For a 3-inch cylinder this gives $0.53 \times 3 - \frac{1}{8} = 0.965$ inch; for a 4-inch cylinder this gives $0.53 \times 4 - \frac{1}{8} = 1.495$ inches; for a 5-inch cylinder this gives $0.53 \times 5 - \frac{1}{8} = 2.025$ inches.

The first example is too small, the second is about right and the third is too large. Another case of too large a constant.

Lloyd's rule for the crank-shaft diameter of motor-boat engines is:

$$D_{cs} = C \sqrt[3]{D^2 S},$$

where

D = Diameter of cylinder;

S = Stroke of piston.

The values for C are given as follows:

This is the type of formula which can be used for any size of engine without introducing any guess work.

Four-stroke Cycle.	Two-stroke Cycle.	One Crank Between Bearings.	Two Cranks Between Bearings.
One and two cylinder.	One cylinder.	$C = 0.34$	$C = 0.38$
Three and four cylinder.	Two cylinders.	$C = 0.34$	$C = 0.38$
Six cylinders.	Three cylinders.	$C = 0.36$	$C = 0.40$
Eight cylinders.	Four cylinders.	$C = 0.38$	$C = 0.425$
Twelve cylinders.	Six cylinders.	$C = 0.44$	$C = 0.49$

For open sea service add 0.02 to C.

In these formulas the constant, if any, should have been a small one, and should have been added to the result of the first part, instead of being subtracted; the rest of the formula being changed to suit.

In the discussion of bolts for connecting-rod brasses, on page 576, the statement appears that the dimensions are "actual standard bolt sizes." What standard does this refer to; Association of Licensed Automobile Manufacturers?

On page 577, the section headed "Additional Dimensions for connecting rods," gives, for the diameter of crank pin, the formula

$$D_{cp} = 0.238\,D + \tfrac{2}{3} \textit{ inch}.$$

Again, taking 3- and 5-inch cylinders, we get:

Three-inch cylinder, $D_{cp} = 0.238 \times 3 + \frac{2}{3} = 1.380$ inches; 5-inch cylinder, $D_{cp} = 0.238 \times 5 + \frac{2}{3} = 1.856$ inches.

The constant, $\frac{2}{3}$ inch, is obviously so very large that it throws the sizes out of all reasonable proportion.

In the same paragraph, the crank-pin length is given by the formula

Referring again to the articles in question; on page 577 the length and diameter of center bearing are given as

$$L_{cb} = 2.8\,D_{cb} - 2.2 \textit{ inches},$$

and

$$D_{cb} = 0.53\,D - \tfrac{1}{8} \textit{ inch}.$$

For a 3-inch cylinder this gives $L = 2.8 \times 0.965 - 2.2 = 0.502$ inch; for a 4-inch cylinder this gives $L = 2.8 \times 1.495 - 2.2 = 1.986$ inches; for a 5-inch cylinder this gives $L = 2.8 \times 2.025 - 2.2 = 3.47$ inches.

This formula is obviously inaccurate for any size, except in the neighborhood of a 5-inch cylinder.

For the rear bearing, page 578—the length is given as

$$L_{rb} = 5.33\,D_{rb} - 5.66 \textit{ inches},$$

the diameter being

$$D_{rb} = 0.53\,D - \tfrac{1}{8} \textit{ inch}.$$

For a 3-inch cylinder this gives $5.33 \times 0.965 - 5.66 = -0.517$ inch; for a 4-inch cylinder this gives $5.33 \times 1.495 - 5.66 = 2.31$ inches; for a 5-inch cylinder this gives $5.33 \times 2.025 - 5.66 = 5.13$ inches.

Of course, in this case the results look much worse on account of the inaccuracies of the crank-diameter formula; the large constant, however, has to take its share of the blame. The crank-shaft web formulas show the same lack of uniformity for different sizes, due to the use of the large constant.

The valves are treated in the same way. This is one place, at least, where a simple formula giving the valve diameter as a direct function of the cylinder diameter, would have been absolutely accurate. Such a formula as $V_d = 0.5D$ would have been very close to what is desired.

I have endeavored to show in the preceding, the fallacy of making empirical formulas which contain a large constant to be added to, or worse still, subtracted from that part of the equation which consists of the proportional relations of the part to be designed, to the part from which it is derived.

The object Messrs. Kessler and Lewis had in compiling this data seems to have been, not to pick out the best features of the different designs and combine them in one engine which would seem good to them, but to combine all the types and give averages for each part, deriving formulas which would give these average sizes for any size within the range considered. The introduction of the constants which are added or subtracted destroys the accuracy of the formulas for giving average sizes.

To get the average, would it not have been possible to work them out by simple arithmetic? Evidently this was not the method used and I would very much like to know what way they were derived, and the reasons for using the methods which were used.

In conclusion, I wish to state that I fully realize the fact that the criticism of an outsider is very likely to be based upon false assumptions, and that the old definition of a critic as "a man who couldn't do it himself," is usually correct. The general information contained in the articles is exceedingly good; especially the section on valves, dealing with the speed of gases and the setting of the gear.

JOHN STEVENSON.

Ottawa, Canada.

An Automatic Screw Driving Machine

The automatic screwdriving machine described on page 206, Volume 33, Part 2, recalled to my mind one somewhat similar that I was instrumental in designing a short time ago. The machine we constructed had an automatic washer feed, but the screws were fed by hand. As the machine is used only occasionally for the temporary assembling of the screw, washer and plate, it is doubtful if an automatic screw feed would be much of an improvement over the hand method. The washer feed is an absolute necessity, as it would be practically impossible for the operator to handle both screws and washers and make any progress.

This screwdriving attachment was rigged up on a bench drill press, as was the one previously referred to. It works very nicely and is far superior to the old way. The drawings need very little explanation. In Fig. 1, are shown the plate assembled with screw and washer, and an assembly view of the attachment. *A* and *A'* are the screw jaws which are held in position by spring pressure. *B* is the washer-feed slide, operated by the cam *D* and lever *E*, which carries the washers from the magazine *C*, under the jaws *A A'*.

Cam *D*, as will be seen from the cuts, is operated by means of a rack and pinion. When the operating lever is depressed, after the screw has been placed in the feed jaws, the cam descends, throwing over the washer-feed slide, placing the washer under the screw and over the plate which has been set in place by the operator. The screwdriver blade now locates itself in the screw slot and, pushing the screw through the washer, drives it into the plate.

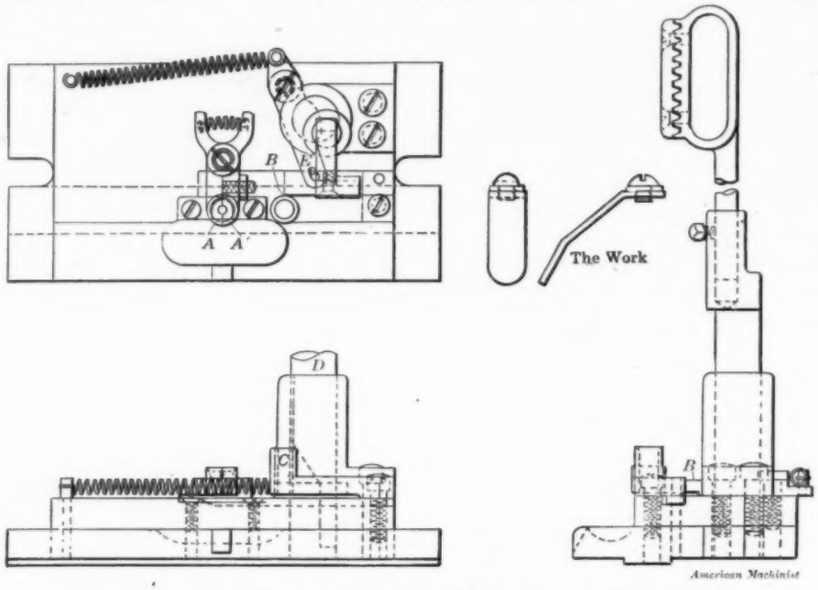


FIG. 1. ASSEMBLY VIEW OF AUTOMATIC SCREW-DRIVING ATTACHMENT

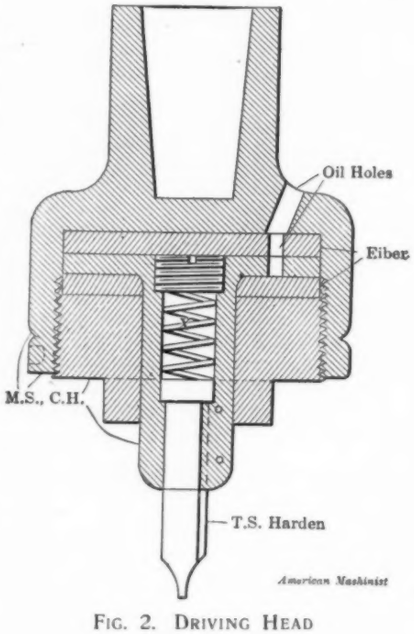


FIG. 2. DRIVING HEAD

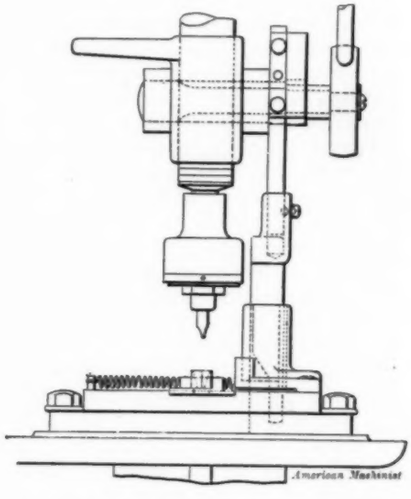


FIG. 3. ATTACHMENT IN THE PRESS

Fig. 2 shows the construction of the screwdriver. The spring *X*, above the blade, allows the blade to slip lightly over the head of the screw until it finds the slot. The friction drive is also worthy of note. This feature prevents the blade tearing the slot after the screw has bottomed while, at the same time, it is positive enough in its action to send the screw firmly home.

Fig. 3 shows the attachment on the press.

W. R. HUMELBAUGH.

Rochester, N. Y.

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American Machinist

The Path to the Factory Door

"If a man can write a better book, preach a better sermon or make a better mouse trap than his neighbor, though he build his house in the woods, the world will make a beaten path to his door."

Granting the truth of this statement, the point of interest becomes one of the width of the path. While any man may well be pleased to see his neighbor come over with a wheelbarrow asking for a mouse trap, the world's success in the mouse-trap business is expressed in carloads.

Two ideas are expressed in this quotation; one that a man may manufacture goods in the country, the other that if his are the best goods there is no need to advertise them. Both these statements are dependent on circumstances, for their truthfulness. Some kinds of business have always flourished in the woods. A shoddy mill may hide itself in a secluded spot next to a waterfall and never see a customer from one year's end to another. Such mills sell through jobbers and by sample, while manufacturers of steam engines of any considerable size find that their customers want to see how they do their work. Every intermediate stage is to be found, and for some a beaten path must be laid with 90-pound rails to get the customers to travel it.

Again, will the best goods sell themselves? That they should is true. That no one should make other than the best goods is also true, if we mean by "best" not the highest priced, but that which best serves our purposes. The best lathe to one may mean the one that his rich neighbor just threw on the junk heap, one class of work being rough repairing, and the other fine tool work.

If every manufacturer were absolutely truthful about his goods, his customer would be able to tell which goods to select for his particular case. The maker of tools and jigs rates all but the highest-grade machinery as junk. The repairer of junk rates all high-grade machinery as rich men's playthings. The selling expense of a manufacturer, including discounts to dealers, tells a story of misunderstandings which must be threshed out before a machine is sold and made to stay sold.

It may be said by some that a large part of this selling expense is an economic waste, that the purchaser should be compelled to beat the path to the manufacturer's door, but in the imperfect state of society, the manufacturer who adopts that idea stands still.

One of the signs of progress toward this millennium may be seen in the more legitimate form which selling expenses are assuming. It is not so long ago that the unsuspecting countryman who drifted into New York to buy machinery was dined and wined until he was ready to buy whatever the salesman most wished to sell. Today even motor cars are being sold as business propositions. The tendency to use printers' ink to open negotiations, to be followed by personal persuasion only upon firms known to be in the market for goods, is another step in the right direction. This is marked by the tendency to tell the story of the goods in the advertisement and by the tendency to put men on the road who know the goods, and how to prescribe for the wants and needs of their clients.

But because we still advertise and still send out commercial travelers, the truth of the quotation with which we began is not lessened. On the other hand, we use advertising and salesmen simply to answer the unspoken request of the purchaser for an answer to his question, "Where is the best mouse trap made?"

Interest in Apprentices

Perhaps the most striking feature in the recent conference of the instructors of apprentices of the New York Central Lines was the universally expressed belief concerning the value of personal interest in the apprentice.

We all know the advantages of personal encouragement and how it spurs a boy on to still better things. But this should not be reserved for prize winners only, as it is even more necessary in the case of the backward boy, who usually realizes his deficiencies all too keenly. For the most part, boys are in a plastic condition during their years of apprenticeship and the instructor can do much toward making or marring their entire future. It is neither necessary nor wise to do too much for the boy, but a healthy human interest, entering into their life outside the shop to show that they are considered more than mere machines, has a lasting effect.

When a high official of the road stops to visit the school in session; to see what the boys are doing, and to show his interest in their work, its effect is more widespread than might be imagined, and gives the boy an entirely different idea of the real, as well as the official man who is his superior officer.

The sooner the value of a real personal interest in apprentices is thoroughly realized, the better it will be for all concerned.

Automatic Spring and Air Chucks

By E. A. Dixie

A movement of a foot lever or a turn of an air valve starts or stops the lathe spindle and simultaneously closes or opens the chuck.

The Garvin Machine Company, New York, is putting on the market a very complete line of automatic chucks with two and three jaws in various sizes.

Fig. 2 shows a two-jaw chuck disassembled. The body *A* is of the ordinary type but carries an actuating jaw *B*, which has a series of inclined slots milled in it, tongues in the central draw plug *C* fitting into these inclined slots. By moving the plug to the rear both jaws are forced toward the center by the wedging action of the inclined slots and tongues. The dovetailed jaws are adjustable by means of a screw on the actuating jaws to and from the center, and when adjusted are locked in place by a locking screw. The dovetailed jaw is dovetailed on both sides, so that it can be reversed and grip either external or internal work. In the latter case an extra piece *C*, with the diagonal slots running in the opposite direction, is necessary. The adjustment of the jaws is, therefore, entirely independent, but in operation they work simultaneously.

In detail the three-jawed are similar to the two-jawed chucks. The three-jawed chucks are furnished with the regular step type of jaws and can be fitted with various other types of jaws to accommodate all classes of work.

The chuck is screwed on the nose of the spindle in the usual manner a pull rod or tube is then screwed into the central plug in the chuck, and the other end attached to the operating mechanism. A number of styles of operating mechanisms can be applied, governed by the conditions found in practice.

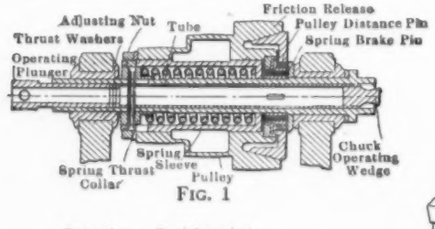


FIG. 1

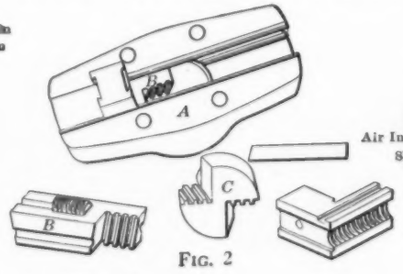


FIG. 2

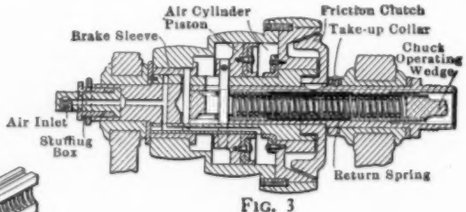


FIG. 3

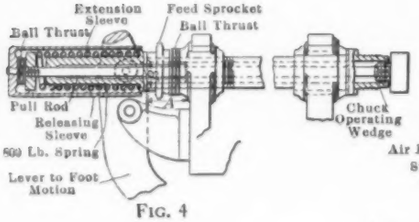


FIG. 4

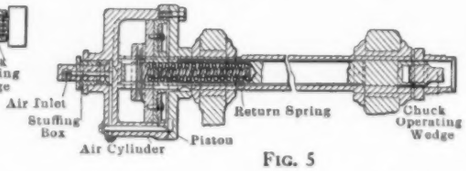


FIG. 5

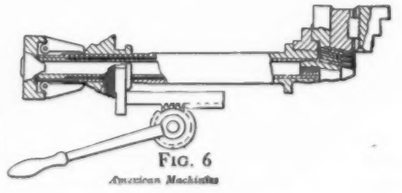


FIG. 6

AIR- AND SPRING-OPERATED AUTOMATIC CHUCKS

SPRING-ACTUATED AUTOMATIC CHUCK

Fig. 1 shows the stop and open-spring mechanism. A heavy spring is mounted inside the cone pulley, around the spindle. At the rear it bears against the spring-thrust collar through which passes a taper pin. The pin is a drive fit in the collar and also in the draw rod, but it slides, in an elongated slot, in the spindle. The spring exerts a pull of 800 pounds on the draw rod, and the wedging action of the inclined planes in the chuck multiplies this by four, giving a resultant grip, exclusive of friction, equal to 3200 pounds on the work. A foot treadle is attached to the operating plunger at the rear end of the spindle. A slight downward pressure of the treadle carries the tube forward and automatically carries the friction out of the cone. The momentum of the spindle is stopped by the brake pins and washer at the rear of the front box. The cone pulley is now running idle. The full movement of the treadle opens the chuck jaws, releases the finished piece of work and the chuck is ready for the reception of the next piece.

On releasing the treadle the pressure of the spring first closes the jaws on the work and then carries the friction into the cone, which starts the spindle at full speed.

In practice, with the ordinary method of chucking, in many cases it takes much longer to chuck the work than it does to do the actual machining.

AIR-OPERATED AUTOMATIC CHUCKS

Where compressed air is obtainable the system shown in Fig. 3 can be used to advantage. It consists of a piston inside the cone pulley. Piping is attached to an air inlet at the end of the spindle, the operating valve being placed in a position convenient for the operator.

When air is turned on it passes through the chamber to the front of the piston, forcing it back and closing the chuck jaws on the work. The pressure of the air in the opposite direction carries the cone pulley on to the friction which starts the spindle forward at full speed. On releasing the air, the spring inside the spindle forces the pulley off the friction, and the momentum of the spindle is checked by a multiple-disk brake (not shown in the cut) on the rear spindle bearing, which leaves the cone pulley running free. The pressure of the spring in the other direction carries the tube forward, opening the chuck jaws, and the machine is now ready to receive the next piece.

AIR PRESSURE REQUIRED

The air pressure necessary for operating is from 70 pounds up. For work which does not require a heavy grip, a reducing valve may be placed in the pipe and adjusted to give the necessary pressure.

ELASTIC GRIP OF THE AUTOMATIC CHUCK

With the ordinary chuck where the operator centers the work and tightens each jaw separately, one jaw may have a bite on a high spot on a casting. Under the cutting strain the casting may shift slightly, which loosens it in the chuck and the operations of centering and tightening will have to be done over again. With the air-operated chucks this is impossible, as the jaws are at all times forced against the work by the elastic pressure of the air, and any variation in size is automatically accommodated.

These operating mechanisms are all self-contained and there is at no time while the machinery is running any pressure on the spindle boxes.

Conditions Governing the Choice of Mechanism

The air system is, of course, the most powerful and convenient, because it saves physical effort, and where the number of pieces handled per day exceeds 1000, it is the most desirable, but where there is no compressed-air system or where the number of pieces does not exceed the limit stated above, the spring-actuated chuck will be found efficient.

Application of These Chucks to Machines Already Built

The methods just described show applications to machines built by the Garvin Machine Company, but machines already in use can be equipped with the spring system shown in Fig. 4, or the air system shown in Fig. 5. These mechanisms are mounted on the rear end of the spindle. They operate the chuck only, the starting and stopping being done by the countershaft. They are for this reason somewhat slower than those already shown, as the spindle is not stopped instantly.

Double-acting Air Cylinder for External and Internal Work

A double air cylinder is also made, which takes the air in on either side of the piston, gripping and releasing by air pressure without the aid of a spring. This system is convenient for gripping either internal or external work, as both these can be accommodated without reversing the jaws of the chuck.

Chucking Hardened Spur and Bevel Gears. Range of Opening

Fig. 8 shows a three-jaw air-operated chuck, arranged on a Garvin hole-grinding machine for gripping a bevel pinion by the pitch line.

Fig. 7 shows the arrangement for gripping a spur gear on the pitch line. The jaws are adjustable to and from the center, for different-sized gears, they also carry a hardened plate on which is mounted a hardened roller which grips the gear at the pitch line. This plate is adjustable sideways for gripping gears where the number of teeth is not divisible by three.

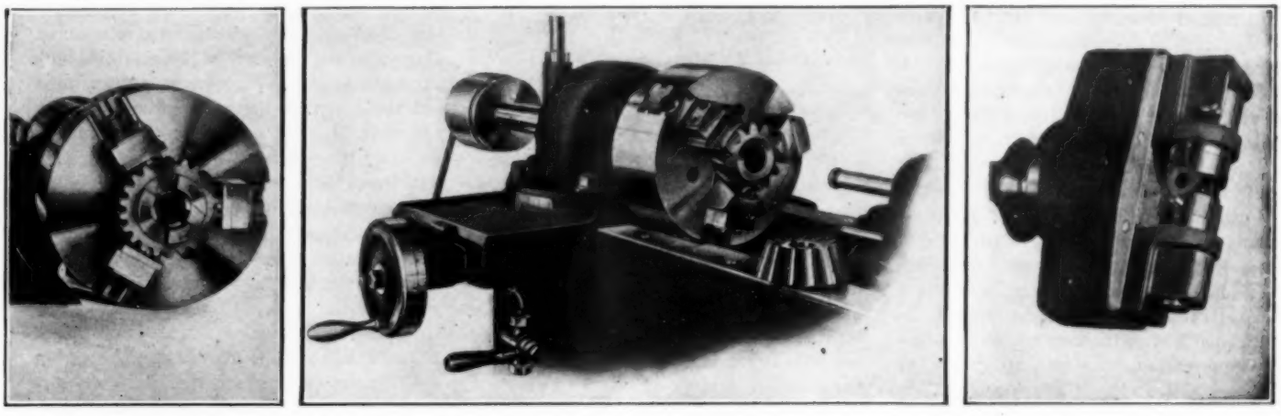
These chucks may also be operated by the hand-lever mechanism, as shown in Fig. 6. With this mechanism the chuck jaws are opened 1/16 inch on the diameter, which is sufficient for a grip on finished work. The spring or air-operated mechanisms give an increased opening and the three-jaw chucks are arranged to open ⅜ inch, while the two-jaw style is made in two types, one of which opens ⅜ inch and the other ¾ inch on the diameter.

Adaptability to Special Purposes

The chuck shown in Fig. 9, known as the automatic index chuck, has a wide field of adaptability for that class of work having two or more points of work to be operated on lying in the same plane. These chucks are identical in construction with the former ones except that they have index jaws. The operating of this style can be with any of the various operating mechanisms.

Considering the inside spring as shown in Fig. 1, the pressing down of the treadle stops the spindle and releases the heavy pressure on the jaws and automatically puts on an auxiliary pressure to hold the piece firmly in position while it is being indexed. On releasing the treadle the heavy grip goes on and the spindle starts forward at full speed. To remove the work from the chuck the treadle is pressed down, thus stopping and, by a turn of the finger lever shown, the auxiliary grip is released and the piece is taken out, having been finished at one chucking.

For that class of work where one end is finished from a thread cut on the opposite end, a chuck is made which allows the piece to be screwed on the plug. The air or spring mechanism then pulls the piece against the face plate holding it firmly while the machining operations are being done. On releasing, the piece is carried forward and can be unscrewed by hand from the plug. The work can also be put on and taken off while the spindle is running. Fig. 10 shows a Garvin geared friction-head power-feed monitor lathe, equipped with a 12-inch two-jaw adjustable reversible, automatic chuck which is operated by the outside air system. The stopping of the spindle is, in this case, done by throwing the friction lever on the headstock to a neutral position.



Figs. 7, 8 and 9. Special Applications of the Automatic Chucks

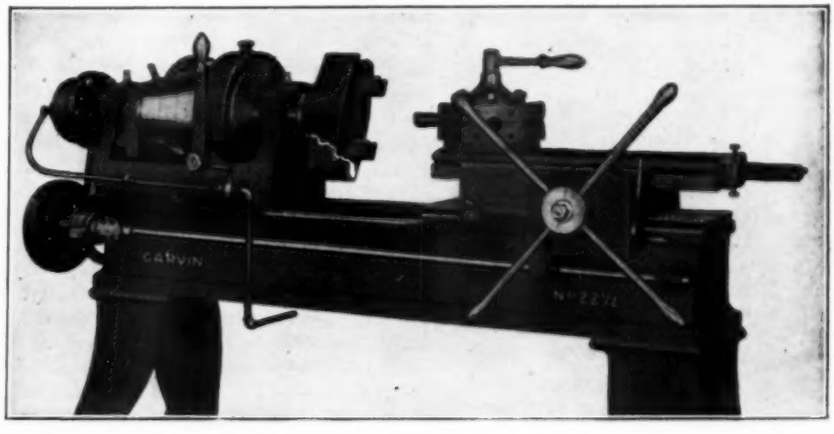


Fig. 10. The Outside Type of Air Control

Conference of Apprentice Instructors

Editorial Correspondence

The fourth annual conference of the instructors of the New York Central lines apprenticeship system brings out many interesting features of their work and its results.

The fourth annual convention of the apprentice instructors of the New York Central Lines was held in New York City, January 27. After the conference was called to order by C. W. Cross, superintendent of apprentices, several letters were read, and the introductory address made by the superintendent. His assistant, H. Gardner, made his annual report of the results obtained from July 1, 1909, to July 1, 1910, which included the following interesting items:

The total number of apprentices enrolled to July 1, was 617. There are three apprentice clubs at which 17 papers have been read by apprentice boys at club meetings, mostly on subjects pertaining directly to locomotive construction, but with an occasional topic of general interest. These clubs also gave nine outings and social events of one kind or another, all of which indicate the spirit of getting together, which means so much in any organization.

Seeing the Results

This apprentice system is now reaching the point where 63 have been graduated and are now receiving full journeymen's wages. Twenty-five boys have been promoted to permanent positions of responsibility, including instructors, locomotive inspectors, machine-shop foremen, round-house foremen, draftsmen, inspectors of materials, and other equally important positions. Many of the boys assist in the class-room work during school hours, and the drawing classes have made 3672 drawings and tracings, which have been added to the railroad company's files.

All of the schools report striking examples of work which has been done by the boys in the various stages of their course, drawing, designing, inspecting and other responsible work being included in the list. It is perfectly safe to say that in very few cases would boys be able to do such work as this without the aid of competent and systematic instruction.

The Papers Presented

The following papers were read by the instructors at the various points and discussed vigorously:

"Should We Give Prizes for Excellence to a Few Apprentices or Try to Advance Moderately a Large Number for the Benefit of the Company?" H. S. Rauch; "The Effect of Modern Apprenticeship on the Mechanic of the Future," F. Deyot, Sr.; "New Courses of Electrical Apprentices," C. A. Towsley; "Handling our Laboratory Work and the Value of a New Class-room Course for Machinists Based on Shop Practice," E. Kennedy and W. F. Black; "What is the Best Method of Conducting the Class-room Instruction with the Walschært Valve-gear Model?" B. Frey; "A Suggestion for an Improved Method of Reporting Home and Class-room Problems for Large Schools," A. L. Devine; "The Backward Boy and How to Lead Him to Success," F. E. Cooper; "What is the Best Method of Keeping the Boys Satisfied with the Trade and Keeping in Their Minds the Necessity of Being Loyal?" A. W. Martin; "Benefits Derived from Monthly Reports of Standing Sent to Parents. Coöperation and Appreciation of Parents," G. Kuch, Sr.; "A New Daily Attendance Record for Apprentices," G. Kuch, Jr.; "A New Drawing course for Carbuilder Apprentices," A. A. Schafer; "The Education of the Apprentice and What to Do with Him, by One of Them," Richard Keefe.

An abstract of the remarks by Mr. Deems, general superintendent of motive power, follows: "I have watched with a great deal of interest the work that you men have been doing, not only watched it from the reports sent in and investigations that I have made in going over the road, but by making inquiries from others outside of railroad work who have investigated your work along the line, and I want to say that I am only too pleased indeed to congratulate you on what you have done and what you are doing. It was not an easy task when you took it up. You had very little to guide you in the work, and I feel that what you have accomplished with Mr. Cross and others is much more than I hoped for in the length of time that you have been at it. I know there are many ways in which the young men are being greatly benefited. In fact, I have had this told to me by those outside of railroading and those engaged in educational work elsewhere, I have had it said to me by some of them that they believed the boys that were interested and who were going through our school getting a tehcnical education and manual training at the same time were better off on an average than boys who were going through the best technical schools; very much better off, and I firmly believe that to be true.

"We must not ever think we have reached perfection. We must try to do a little better tomorrow than we did today, and I can say I hope to be able to see many beneficial results from the mechanics in our shops in six or seven years from now.

"Other roads are doing much the same as we are and, of course, they will be turning out mechanics as we are doing. Our shops are being manned with a class of mechanics better than we could obtain heretofore, and I don't believe that there are any shops in the world that are manned with a set of men that have had the training that these young men are getting today, and an important fact is, they are getting it without any cost to themselves, and even getting paid for it, and I am sure there is no doubt that the ultimate result will be to the benefit of the company."

Among the many ideas which were brought out in the discussion following the various papers was the necessity for industrial intelligence in addition to what we commonly call book learning. The object of all instruction of this kind is for the production of skilled workmen, and the teacher in industrial work gets closer to his pupils and exercises a wider influence over their future, than instructors in any other line.

It seemed to be generally agreed that apprentices from the high school advanced more rapidly than those with less schooling, but, in most cases, the high-school boy does not remain a workman, but almost invariably seeks other fields of usefulness.

There are also many cases where boys will do good work in the shop and poor work in the school, and *vice versa*, owing to some peculiarity of their make-up. Some instructors found that, in most cases, boys who were bright in one department were also bright in the other department.

Prizes Not Always Good

The discussion in regard to the offering of prizes brought out many interesting points, but it seemed to be the general opinion that it would do more harm than good. Mr. Davis, representing the Santa Fe Railroad, told of their practice of giving every boy who completes his apprenticeship satisfactorily, $75 in cash at his graduation, and another $75 at the end of six months, if he remains with the company.

H. S. Rauch gave as his experience, that it was a mistake to have the boys come to depend on the instructor instead of being placed on their own responsibility as much as possible. While the boy should receive all the instruction necessary, he should be made to work out

many of his own problems without assistance so as to develop his self-reliance.

An Electrical Course

An outline for a new electrical course was given by C. A. Towsley to include instruction for shop men using motors and also a more complete course for those who wish to become connected with the electrical departments of the railroads.

The experience of the Boston Edison Company, in this respect, was stated briefly by Mr. Russell, director of the Franklin Union, showing that lectures, even when illustrated with lantern slides, do not reach the men nearly so effectively as an actual contact with the machinery itself. After trying this for a year, the Boston Edison Company are sending their men to the Franklin Union, where they can be instructed by the actual handling of the apparatus, repairing electrical machinery, as the actual contact seems to give them a much better understanding of the whole proposition. As the apparatus for such a course is rather expensive, Mr. Russell suggested that an instruction car might be equipped, in the same manner as the air-brake car, and sent over the roads, stopping at the different points as long as might be necessary.

Learning the Names of Machines

One of the first requirements of any line was considered to be a learning of the proper names of the machines and tools used, as the lack of this is a decided handicap in every way.

It is advantageous to repeat certain kinds of work from time to time, as such as laying out shoes and wedges, boiler sheets, etc., to make sure that the boys thoroughly understand the principles involved so that they can go ahead with the work themselves. It is also found better to keep the boys steadily at one class of work until it has made an impression, instead of dumping them from one thing to another, which seems to be one of the failures of some of the public and other trade schools.

It is best to use the locomotive or other machines themselves in demonstrating points, so as to reduce the amount of imagination required to the lowest possible point. As an instance of this, Mr. Kennedy told of a class at Depew, which went to the shop one Sunday and trammed an engine on the erecting floor to satisfy themselves that they could do the actual work after learning the system from the wooden model.

Shop Kinks at Home

The comparatively new practice of including practical shop kinks in the home-problem course, was highly commended by W. F. Black, of Oswego, and has been found very useful by their boys. These give the boy an idea of standard kinks, which are sometimes overlooked in the rush of the day's work by the shop instructor. Instruction of this kind is also given in the class and has been found advantageous on account of the absence of the distractions of the noise and hustle of the shop itself. These pointers give the boy a taste for more knowledge along this line and prompt him to ask questions which would otherwise not have occurred to him.

Backward Boys

The question of dealing with backward boys receives considerable attention. Entrance examinations even of the lowest grades, prove a stumbling block to some who are extremely diffident and who are unable to express themselves clearly in writing. Although due allowance is made for this by most examiners, the plan pursued by the Santa Fé Railroad of not holding an examination until after the boy has been in the service six months, seems to have some advantages. While it may require more weeding out than would otherwise be the case, you may secure boys on the other hand who will develop into good workmen but who would be unable to pass any examination however slight.

The backward boy often develops into a good machinist and should be encouraged in every way possible, for while he may not be the most brilliant workman, there is always room for the good mechanic of average ability or a little more. As one instructor put it, the slow boys must be fed with a spoon, but they can be made to get there just the same.

Interesting the Parents

The advantage of interesting the parents of the apprentices was brought out by G. Kuch, Sr., and others. A letter is sent to the parents inclosing a report card for their signature and urging them to become interested in the work being done by the boy. The letter and first report are sent by mail to insure their reaching the parents and securing their signatures on the first report. Each following month the reports are sent home by the boys themselves and must be returned signed in the same way. Although many of the parents are foreign born, some of them hardly speaking English, with very few exceptions they take a keen interest in the instruction being given their sons and coöperate as fully as possible with the instructors.

The question of securing loyalty was freely discussed, it being clearly shown that this depended as much on the railway officials as the apprentices and men. When a boy's superiors show loyalty by their example, it has a much more far-reaching effect than any amount of preaching that may be done in regard to it. The stimulus of personal interest through master mechanics and others visiting the school frequently was clearly brought out. A few words of encouragement to a boy who is trying to do good work, whether he succeeds as well as some of the others or not, has a marked effect. It is also desirable in every way that officials show the boys their human side as well as the other, as this brings about a much closer relationship and interest in the work that is beneficial to all concerned.

Industrial Accidents

The increasing attention which is being given to industrial accidents and their prevention is apparent in many quarters. At the next monthly meeting of the American Society of Mechanical Engineers, 29 West Thirty-ninth street, New York City, John Calder, manager of the Remington Typewriter Works, Ilion, N. Y., will bring out some interesting and appalling facts in this connection. Mr. Calder believes that much good can be accomplished in the preventing of industrial accidents by an organized movement on the part of engineers and engineering societies, who have to do with industrial machinery of any kind, as he considers that at least one-third of the accidents could easily be eliminated.

Personals*

E. T. Hendee, assistant to the president of Joseph T. Ryerson & Son, Chicago, Ill., and C. A. Johnson, president of the Gisholt Machine Company, Madison, Wis., sailed for Europe on February 1, to be gone for a six weeks' business trip.

Edward Blake, Jr., who has been manager of sales for the Wells Brothers Company, Greenfield, Mass., for the past four years, and a director of the corporation, severed his connection with that company on February 1, in order to assume the active management of the Canadian Tap and Die Company, Ltd., Galt, Ontario, in which he holds a controlling interest.

Obituary

Rufus S. Bisbee, an early figure in the iron-manufacturing industry in New England, died on January 26 in Chelsea, Mass., his home town, aged 80 years.

Jarvis B. Edson, inventor and mechanical engineer, died on January 26 at his home in New York City. He was born in Janeville, Wis., April 30, 1845, and was educated at the University of New York. He was a member of the American Society of Mechanical Engineers, the Engineers Club and the American Society of Naval Engineers. Mr. Edson organized the Navy League of the United States and was the inventor of Edson's pressure-recording gage; methods of drying gun cotton by compressed air, the making of artificial ivory and about twenty devices connected with these patents.

*Items for this column are solicited.

Shop Equipment News

An Automatic Indexing Multiple Drill for Jacquard Loom "Cylinders"

To meet the demands of a prominent loom manufacturer, producing large quantities of Jacquard loom "cylinders" each year, the Langelier Manufacturing Company, of Providence, R. I., has brought out the multiple-spindle drilling machine, shown in Fig. 1.

The main elements of the machine are a working table, actuated by a ratchet rack, traveling back and forth upon the ways of a substantial iron frame. This frame also supports the hole-spacing pilot wheel, main driving shaft, and accessory mechanism. Continuing above the level of the table, it forms a rigid column with a projecting arm which carries the drilling crosshead and lateral, hole-spacing devices.

Two spur gears on the driving shaft revolve face cams in contact with the ends of bell cranks. The other ends of these cranks trip pawls, pushing forward the teeth of the large indexing ratchet wheel. A number of change gears are also mounted on the index-wheel shaft for varying the travel speed of the working table as needed to suit the spacing of holes in the various "indexes." The motion of the last change gear is transmitted by bevel gears to the pinion wheel in mesh with the rack under the working table. This moves the table forward the required amount.

The pilot wheel is fitted with a set of dogs. As it revolves they successively trip two levers which advance and recede short racks above and below a small pinion. As the shaft of this pinion turns, the quadrant gear on the end of a bell crank moves, and shifts the belt. The same trip, by mechanism connected to the drilling head prevents the drills from coming down on the work while the table is indexing. The space indexed is determined by the distance apart of the index-wheel dogs. By setting these dogs for any spacing wanted, one cross row of holes, or any number of cross rows may be left out at will.

To insure absolutely true holes and decrease tremor of the drills, the drill head is provided with a steady jig, shown in Fig. 2. This was deemed necessary because of the small size of the holes and because the material is hard maple. A vertical adjusting device is provided, which keeps the jig close to the work, and makes the drills drive firmly whether the piece bored is thick or thin.

Owing to the close spacing of the holes, and in order to retain rigid and powerful spindle construction, spindles are provided for only each alternate hole. At every stroke of the head, the drills bore eight holes crosswise for fine index and six for "American" and "French." As they pull out of the work, the head automatically shifts sidewise to a position midway of the holes previously drilled. The head makes 40 strokes per minute alternately right and left of the table. With the "American" or "French" index, the machine bores 240 holes a minute, and 320 with the "fine" index. These indexes correspond to the coarse, medium and close spacings of holes in the pieces shown in Fig. 3.

A hand adjusting device is supplied for locating the table exactly at the proper spot for the first cross row of holes.

After boring the last holes in the cylinder, a dog on the pilot wheel stops the machine.

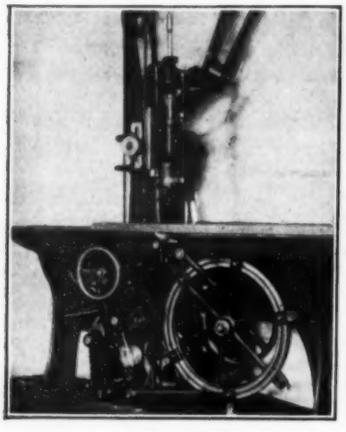
To return the table to its starting position, a foot lever is pressed, releasing all the pawls, and the table is brought back by the action of a weight at the rear of the machine.

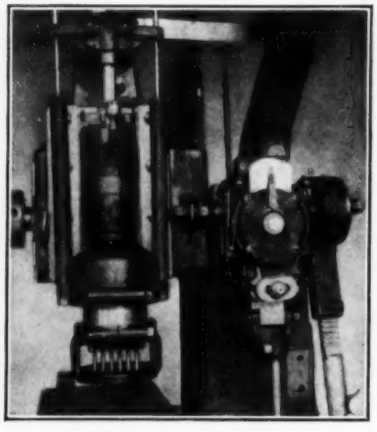
For some varieties of "cylinders" the holes are made with special wood bits, while with others tapered point drills are used.

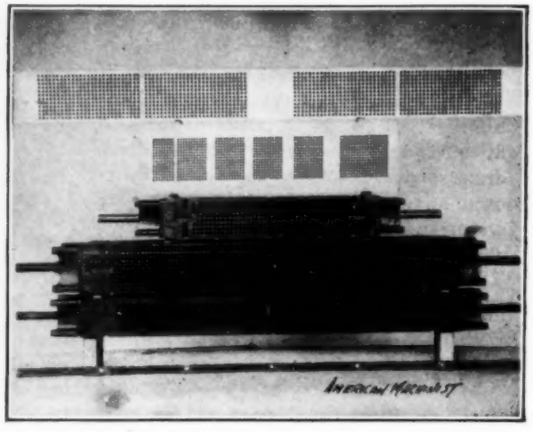
The "cylinders" are held, while boring, in a fixture clamped to the T-slots of the working table.

The main drilling spindle runs at 3275 revolutions per minute, and the drills at 300 revolutions.

ANY and all new or improved machines, tools or shop appliances of interest to men responsible for results in machinery-making plants will be briefly illustrated and described here — the machine shop news.
A more full and detailed description will be given — when it is real news — if it can appear here first — before it is sent to other papers. ALL descriptions appear in ALL four editions of the paper—Weekly, Monthly, Weekly English and Weekly German







FIGS. 1, 2 AND 3. THE MACHINE AND THE WORK

"Acer" Brake Horsepower Tester

This device, illustrated in the accompanying halftone and line cut, is designed to determine the horsepower developed by a gasolene engine or other motor, directly from the speed and torque at the flywheel rim. The results of the test are read at a glance from a line automatically traced on a specially ruled chart.

Referring to the line cut, Fig. 2, the lever and point *F*, in connection with the

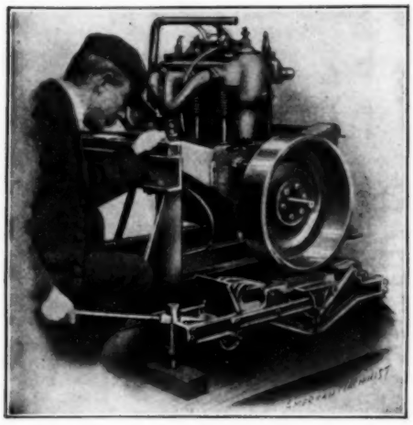


FIG. 1. THE DEVICE IN USE

pivot *G*, are used to press the friction wheel *B* against the rotating flywheel of the motor. Inside of *B* at *C*, is a centrifugal device operating the lever *T*, carrying the tracing point *D*, moving it in proportion to the speed of *B* and, consequently, that of the motor flywheel. At the same time the upward pressure brings the pads *J J* against the rotating flywheel rim, and the friction produced draws to the left, the cradle *H* traveling on rollers *S*, against the resistance of the spring *K*. Attached to cradle *H* is the rack *R*, which rotates the drum *E* by means of a pinion on its shaft. The drum *E* carries the specially ruled chart upon which the tracing point *D* draws a curve depending upon the speed of rotation and the pull. By means of these two factors and the special ruling on the chart, it is possible to read directly the horsepower developed, without computation.

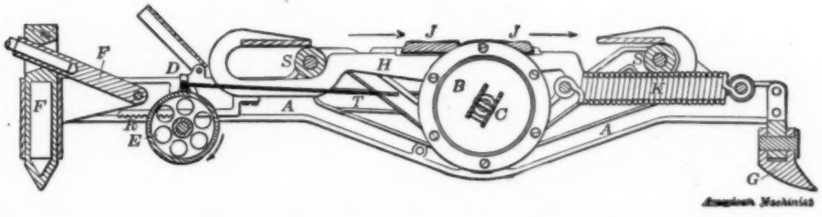
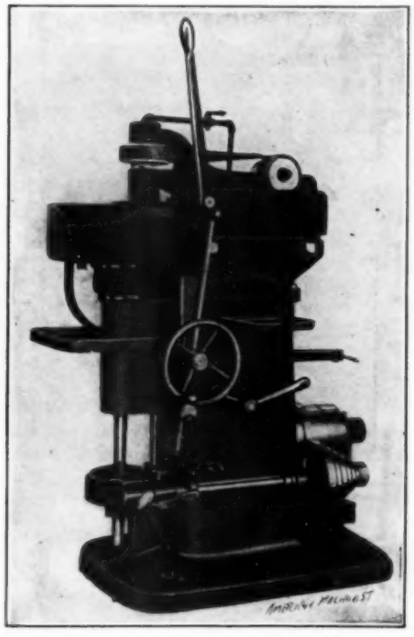


FIG. 2. SECTIONAL VIEW OF THE DEVICE

Charles G. Norris, 28 Deansgate, Manchester, Eng., controls the American rights to this device.

A Surface Grinder

The halftone shows a new rotary surface grinder of the cup-wheel type, with vertical spindle made by the Bay State Grinder Company, Worcester, Mass. The work is mounted on a Walker magnetic chuck, which is in turn supported by a knee, operated by a rack and pinion, which feeds the work straight up to the wheel, against an adjustable stop, which assures exact duplication of the work.



A SURFACE GRINDER

The entire handling of the machine is accomplished by the single lever as shown in the illustration, which also controls the operation of the clutch for the driving mechanism of the chuck. The vertical spindle for the chuck is driven by spiral gears running in an oil bath.

The machine is also equipped with a handwheel feed, graduated to 0.00025 inch, this being very desirable for grinding work, the duplicate of which is not desired. This feed is entirely separate from the lever feed.

The magnetizing current for the chuck is also operated by the lever, which controls the feeding of the work to the wheel, this current being switched on as the chuck starts to rise. It is switched off as the chuck recedes from the wheel; demagnetizing of the chuck also being accomplished before the chuck ceases to revolve, allowing the work to be easily removed without scratching.

The truing of the wheel is effected by a diamond held in a special holder, which is held in position by the magnetic chuck. The holder is so designed that the diamond can be turned at any angle desired, which lengthens the life of the diamond.

This machine can be equipped with chucks from 6 to 20 inches, and with cup wheels from 8 to 12 inches in diameter. It is regularly fitted with water attachment. The cup wheel produces work much faster than the ordinary wheel. No countershaft is needed as the machine is driven direct from the main line.

A Tool Room Forge

The halftone shows a gas furnace intended to meet the demands of the average machine shop where small tools are to be hardened. It has a heating chamber, 4½x9 inches; entrance, 5x3 inches. With this furnace a high heat can be taken on finished tools without scaling or blistering.

A TOOL-ROOM FORGE

It is furnished either with or without a blower and is built by C. U. Scott, Davenport, Iowa.

Crude Oil Engine for Shops

The St. Marys Machine Company, St. Marys, Ohio, has developed an engine which uses crude oil as fuel designed for use in shops and other establishments requiring power. The engine is started on gasolene, and after it has been warmed up on this fuel, the supply is changed to a 1 to 5 mixture of gasolene and fuel oil. After a further run of perhaps 10 minutes, the gasolene is entirely shut off

and the engine continues to run on fuel oil.

The governor controls both fuel and air, measuring out the correct amount of both oil and air, to suit the change of load.

Positive "Rapid Transit" Vises

The accompanying halftone, Fig. 1, illustrates a new line of wood-working vises placed on the market by the Emmert Manufacturing Company, Waynesboro, Penn.

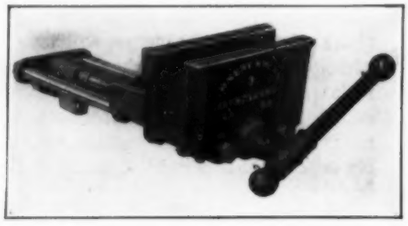


FIG. 1. POSITIVE "RAPID TRANSIT" VISE

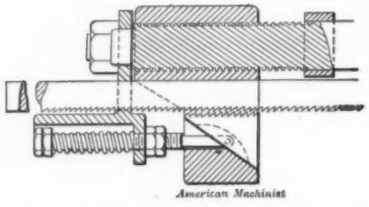


FIG. 2. SECTIONAL VIEW OF LOCKING DEVICE

The essential feature of these vises is the positive locking device, shown in Fig. 2, which operates on a screw having a full thread and engages a case-hardened 5/8-inch square steel lock rod placed within 3/16 inch from the main screw of the vise. The nut itself contains a full thread and in this feature is as strong as a common screw vise. The nut is arranged to contain the case-hardened steel lock rod which passes through the nut and is gripped firmly with equal force on two sides.

The triangular shaped toothed wedge of case-hardened steel is also contained in the nut. This wedge operates against an angle in the nut, so that when the main screw of the vise is operated to the right the nut moves forward and the angle in the lower part of the nut lifts the toothed wedge directly upward into engagement with the grip rod. This engagement is secured without any pressure being applied to the main jaws of the vise and with no more force than is needed to lift the triangular wedge, weighing only several ounces, about 1/16 inch into engagement.

A tilting or angle jaw is provided for holding tapers or wedge-like shapes. A wood-pad form may be attached to the angle jaw and if a greater angle is desired this wood pad may be of wedge shape. Each of the main jaws of these vises is provided with slotted holes to accommodate wood-pad forms. These wood-pad forms may be of any desired shape and can easily be made by the workman.

A Friction Clutch

The J. G. Blount Company, Everett, Mass., has placed on the market the friction clutch shown in the halftones. It is intended for use on line shafts and to be belted direct to lathes, etc., but can be used on countershafts or with single-face pulleys in place of the cone pulley shown. The friction surfaces on the expanding member and in the pulley are large to insure long life. When used as shown in the halftone, for driving speed lathes, an automatic brake is furnished, the movement of the shifter rod releasing the brake when the clutch is thrown in and gripping the rim of the pulley when the clutch is thrown out of engagement.

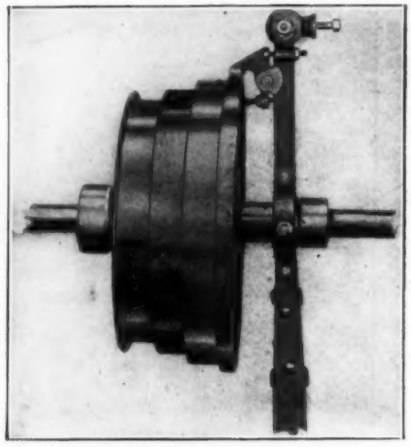


FIG. 1. THE CLUTCH

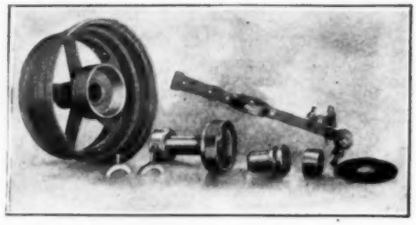
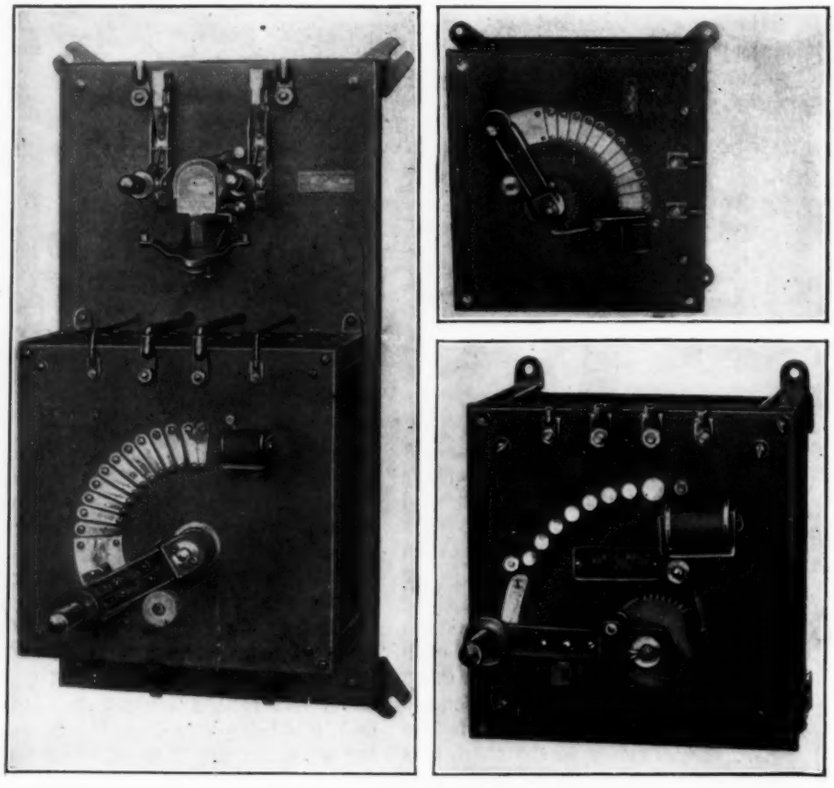


FIG. 2. THE CLUTCH PARTS

Motor Controlling Rheostats

The accompanying halftones show new types of direct-current motor controlling apparatus especially built for machine-tool service and now put upon the market by the General Electric Company, of Schenectady, N. Y. Fig. 1 shows their form A wall panel for 15 to 30 horsepower, 220 volts, and Fig. 2 shows two styles of speed-regulating rheostats.

All are provided with automatic, no-voltage release, connected directly across the line, and the panel shown in Fig. 1 includes an automatic overload circuit breaker. Contact points are specially designed for easy renewal if burned.



SPEED-REGULATING RHEOSTATS

Increasing Shop Capacities

News items for the sales department — where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip — facts

METAL WORKING

NEW ENGLAND

The Iron Works Mill Company, Fall River, Mass., is to install new equipment.

The city of Fitchburg, Mass., contemplates the establishment of a municipal auto garage.

The "P. H. P." Motor Truck Company, Westfield, Mass., is to erect a factory in that town.

A. Lewenburg, Boston, Mass., is to expend $6000 for a public garage on Blue Hill avenue.

The Woonsocket (R. I.) Machinery and Press Company has awarded contract for a four-story addition.

The Sayles Bleacheries, Saylesville, R. I., is to erect a three-story building to be used as a machine shop.

The Atlantic Screw Works, Hartford, Conn., is building an addition of 30,000 square feet, which will double its capacity.

The Hyde Park (Mass.) Steel Castings Company has been sold to J. J. Morgan, who will make extensive improvements.

It is said the United Motor Car Company is considering the removal of its plant from Pittsfield, Mass., to some other locality.

The Meriden (Conn.) Iron and Brass Company has purchased adjoining property and it is said contemplates the enlargement of its plant.

The Barker Motor Works, Norwalk, Conn., is to change its name to Barker Company, and will build an addition for manufacturing auto trucks.

Chas. L. Barker, Norwalk, Conn., manufacturing gasolene engines, will build an addition to his Butler street plant and commence the manufacture of the Murray auto truck.

MIDDLE STATES

Fire destroyed the Hershey (Penn.) Auto Garage. Loss, $100,000. Will be rebuilt.

The Reliance Iron and Engine Company, of Racine, Wis., will locate in La Crosse.

The Commercial Power Wagon Company, Jersey City, N. J., will erect a new factory.

A garage will be erected at Second and Queen streets, Philadelphia, Penn., for Edward Trainer.

The La Crosse (Wis.) Plow Company is planning to double the capacity of its foundry.

The Russell Engine Company, Massillon, Ohio, is in the market for new foundry equipment.

The Northwestern Can Company, Chicago, Ill., has been looking for suitable site for a new plant.

Delaware & Hudson Railroad shops, on Gansevoort street, Troy, N. Y., was burned. Loss, $25,000.

Lawrence Brothers, Sterling, Ill., will build new shops. The company makes door hangers, hinges, etc.

The Stoever Foundry and Manufacturing Company, of Myerstown, Penn., will move its plant to Easton.

Midland Motor Company, East Moline, Ill., will build extensive additions to its automobile plant this year.

The Taylor & Boggis Foundry Company, Cleveland, Ohio, is looking for site on which to erect a new plant.

The Fort Pitt Car Company, Canal Fulton, Ohio, is building an addition for which new equipment will be required.

The Wisconsin Motor Company has purchased a site at Rogers and Burnham streets, Milwaukee, for a new plant.

Fire in barns of the Ogdensburg (N. Y.) Street Railway Company did $17,000 damage. All repair equipment destroyed.

The Parker Boiler Company, Pennsylvania building, Philadelphia, Penn., is looking for a suitable location for a plant.

The Morton Tractor Company, Fremont, Ohio, is reported to be making arrangements for the erection of a new plant.

The International Harvester Company announces that it will erect at Sterling, Ill., a four-story addition to its plant.

Firstnau & Hart will soon remove into a new factory on Woodbridge street, Detroit. They manufacture automobile parts.

The Hyde Metal Boat Company, Watertown, N. Y., is said to be considering the securing of a new site for larger plant.

The Royal Enameling and Stamping Works, of Des Plaines, Ill., is negotiating for site for a branch factory in Oakland, Cal.

The Buckeye Steel Castings Company, of Columbus, Ohio, has bought site at Calumet, Ind., on which a new plant will be erected.

Contract has been let for the erection of a four-story garage at 2314-22 Market street, Philadelphia, Penn., for A. & F. W. Douredoure.

The Premier Motor Manufacturing Company, at Indianapolis, Ind., is building an addition to its plant at Shelby and Georgia streets.

The University of Michigan will ask for an appropriation of over half a million dollars for the construction of new engineering buildings.

The T. H. Brooks Company, Cleveland, Ohio, manufacturing structural iron, skylights, etc., is planning the erection of a large new shop.

The Warner Motor Company, Toledo, Ohio, has been incorporated to take over and extend the business of the Warner Manufacturing Company, making automobile gears.

The Ford Meter Box Company, of Wabash, Ind., has been incorporated with a capital of $25,000, by E. H. Ford, T. W. and W. A. McNamee, to manufacture water meters.

Millburn Motor Car Company, Millburn, N. J., has been organized to manufacture automobiles, etc. Capital, $50,000. Incorporators, Julius, Charles and Henry Wittkop.

The Leyson Supply Company, Syracuse, N. Y., was incorporated with $300,000 capital to manufacture surgical apparatus by S. G. Leyson, F. R. Hillhouse, J. M. Kasiska, etc.

The Auto Iron Company, Springfield, Ohio, has been incorporated to manufacture automobiles. Capital, $15,000. Incorporators, E. S. Kelly, H. E. Otewalt, C. L. Bauer, etc.

Filer & Stowel, Milwaukee, Wis., builders of Corliss engines and sawmill machinery, expect to put up a small separate building for their brass foundry, recently damaged by fire.

The Newburgh (N. Y.) Chamber of Commerce is negotiating with the Imperial Laundry Machine Company, of Boston, Mass., which may decide to locate a plant in Newburgh.

The Louis Biegler Company, Chicago, Ill., has been formed for the purpose of manufacturing metal cornice work. Capital, $25,000. Incorporators, L. Biegler, P. Biegler, C. R. Francis.

The Multiple Jet Carbureter Company, Dayton, Ohio, has been organized to manufacture and sell carbureters by J. W. Raymond, Joseph Friedman, B. Semmelman, etc. Capital, $10,000.

Sterling Electric Works, Lafayette, Ind., has been incorporated with a capital of $200,000, by S. T. Murdock, Thomas Duncan, R. B. Wallace, etc., to manufacture electrical appliances.

The Ranier Motor Company, New York, has been incorporated with $200,000 to manufacture motor vehicles, accessories, etc. Incorporators, J. T. Ranier, P. N. Lineberger, B. F. McGuckin.

The Cooper Heater Company, of Carlisle, Penn., is looking for suitable site on which to erect a new plant for the manufacture of a seamless tank and for the welding of iron, steel, etc.

The Dover Forge and Iron Company, and the Reeves Manufacturing Company, both of Canal Dover, Ohio, are to be merged. Three tin mills will be added to the plant of the Forge company.

The J. G. Knight Hanger Company, Newark, N. J., has been organized to manufacture electric fixtures, pipe hangers, etc. Capital, $10,000. Incorporators, J. G. Knight, C. G. Knight, John Gittens.

The O'Neill Bottle Machine Company, Terre Haute, Ind., has been incorporated with a capital of $10,000 by A. L. Pfau, J. W. Richardson, Frank O'Neill, etc., to conduct a manufacturing business.

The Tadini Automobile Company, Bronx, N. Y., has been incorporated to manufacture motors, motor vehicles, etc. Capital, $25,000. Incorporators, L. Reali, J. Tadini, New York; G. Molla, West Hoboken, N. J.

The Engravers and Printers Machinery Company, New York, has been organized to manufacture engraving and printing machinery. Capital, $100,000. Incorporators, J. F. Fowler, E. P. Eaton, W. Schwartz.

The Orinda Stove and Manufacturing Company, Quincy, Ill., has been incorporated to do a general stove, range and sheet-metal business. Capital, $30,000. Incorporators, C. H. Wurst, Henry Lange, A. H. Stork.

The Brightman Manufacturing Company, of Shelby, Ohio, whose plant recently burned,

has been making investigation with a view to securing site for a new plant for the manufacture of shafting devices, castings, etc.

The Steel Products Company, of Columbus, Ohio, has been incorporated with a capital of $50,000 to make and sell iron, steel and brass products of all kinds by Frank L. Sessions, Vincent A. Drayton, Wilber A. Smith, etc.

Davenport-Manchester Interurban Company, C. A. Steele, Davenport, Iowa, secretary, will commence construction work late in the summer. Machinery and other equipment will be needed. Power plans have not been settled.

The Standard Tube and Metal Company, New York City, is said to be looking for a satisfactory site to concentrate its plants now operating in various cities. Representatives were looking around in Newburgh, N. Y., recently.

Indian Motor Car Company, Upper Sandusky, Ohio, has been incorporated with $10,000 capital to manufacture and sell automobiles, motor trucks and accessories. S. W. Martin, M. M. Stoneburner, William Oipp, etc., incorporators.

The Automobile Owners Manufacturing Company, Goshen, N. Y., has been incorporated with $1,000,000 capital to manufacture and deal in automobiles, etc. Incorporators, F. H. Vahrenkamp, W. Phillipson, G. F. Munns, Jr., New York City.

Southern Ohio Iron Works Company, Cincinnati, Ohio, has been organized to manufacture all kinds of structural and ornamental iron and steel. Incorporators, Charles Biederfœder, Sr., William Wessling, Charles W. Biederfœder, Jr. Capital, $10,000.

The Barnard Carburetor Company, Dayton, Ohio, recently organized by Davis Barnard, C. L. McCrea and others, is planning the establishment of a plant for the manufacture of a new hydrocarbon engine for automobiles. Mr. Barnard has a similar plant in Los Angeles.

SOUTHERN STATES

The Atlantic Coast Line, it is said, will erect a large boiler repair house and shops at Waycross, Ga.

WEST OF THE MISSISSIPPI

The Brown Company, of Mott, N. D., will erect a repair and machine shop.

The California Pipe and Steel Company, Taft, Cal., will build a new factory.

H. Anderson, Seattle, Wash., will build a blacksmith shop at Florentia Court.

The Ramsey Garage, Grand Junction, Colo., will install a machine repair shop.

The plant of the Kansas City (Mo.) Hay Press Company was burned. Loss, about $30,000.

The Houston (Tex.) Structural Steel Company is planning to increase the capacity of its plant.

The Thorp Auto Truck Company, Corvallis, Ore., is contemplating the erection of a factory.

B. Truckman, Portland, Ore., will build a commercial garage. Modern equipment will be installed.

F. W. Shultz, Spokane, Wash., will build a commercial garage. Modern equipment will be installed.

The United Engineering Works, Alameda, Cal., has taken out a permit to erect a foundry building.

The Monach Oil Refining Company, Berkeley, Cal., will build a two-room boiler house and machine shop.

It is reported the Northwestern Railroad has appropriated $400,000 for new shops at Missouri Valley, Iowa.

Henry Husman, Anaheim, Cal., will build a commercial garage. Modern repair equipment will be installed.

The car barns of the Great Falls Electric Company, Great Falls, Mont., were destroyed by fire. Loss, $20,000.

The city of Centralia, Wash., is contemplating the installation of a municipal water system to cost $200,000.

The Dempster, Altona Company, Des Moines, Iowa, manufacturing farm implements, is looking for site for a new plant.

W. G. McKeans, of De Queen, Ark., is interested in the establishment of a plant for the manufacture of fruit and vegetable cans.

Loveland Brothers, of Lone Pine, Neb., will erect and equip a machine shop for general jobbing and repair work, including automobiles.

Abe Schauerman, of the Capital City Woolen Mills, Des Moines, Iowa, will erect a shop for the manufacture of a water filter and purifier.

Charles J. Stanzel, Brownwood, Tex., will erect and equip a building at Aransas, Tex., to be used as a foundry, machine shop and boiler shop.

The Warman Steel Casting Company has been incorporated at Los Angeles, Cal., by G. B. and N. W. Warman, with a capital stock of $50,000.

The machine and woodworking shops of the Hot Lake Sanitarium, La Grande, Ore., were destroyed by fire. It is reported that the shops will be rebuilt.

James English, 32 Montgomery street, San Francisco, Cal., has taken out a permit to erect a motorcycle establishment. Modern repair equipment will be installed.

The Iceless Utility Company, Portland, Ore., a new incorporation by Alexander Ots (Portland), will build a factory for the manufacture of refrigerators and cold-storage appliances.

The Northern Pacific Railroad is reported to be planning to expend $500,000 at Centralia, Wash. Roundhouses and repair shops will be built. Operations will begin in the spring, 1911.

A crucible-steel foundry and rolling mill will be established at Redondo Beach, Cal. Plans have been prepared. The chamber of commerce (C. H. Burnett, president) and furnish information.

H. G. Otis, San Diego, Cal., will occupy the new U. S. Grant Hotel garage, which is being erected. A commercial business will be done, and the shop fully equipped with machinery and tools.

The American Dredge Building and Construction Company has been incorporated at Seattle, Wash., and will build a plant for the manufacture of dredges. B. Bernard is president of the company.

The A. C. Stewart Machine Works, Los Angeles, Cal., has purchased adjacent property to its present plant and contemplates the erection of a large addition. The company specializes in automobile machine work.

The California Iron and Smelting Company has filed articles of incorporation at Los Angeles, Cal., and will build a plant in this vicinity. Capital stock, $500,000. Directors, T. Wiesendanger and E. D. McDonald.

J. L. Reynolds, Los Angeles, Cal., will build a machine shop on San Pedro street. The establishment has been leased by the Rudat & Schwab Company, copper, brass and sheet-metal workers. Modern equipment will be installed.

CANADA

The Regina Tractor Company will equip a $100,000 plant at Regina.

The Canadian Car Company, of Rockfield, Quebec, will extend its plant.

Findlay Brothers Stove Works, at Carleton Place, Ontario, will be greatly enlarged.

The Central Canada Iron and Steel Corporation will erect a $500,000 plant at Montreal.

The Ontario Brass Rolling Mills Company, of Toronto, will make extensive additions to its plant.

The Canadian Kellogg Company will locate a big plant in Montreal for the manufacture of castings.

The American Grain Separator Company, of Minneapolis, Minn., will locate a branch factory in Canada.

Improvements costing $1,000,00 will be made at the plant of the Ontario Iron and Steel Company, at Welland.

GENERAL MANUFACTURING

NEW ENGLAND

The last factory of H. A. Weeks, Lynn, Mass., was badly damaged by fire.

The N. D. Cass paper-box shop, Athol, Mass., has been destroyed by fire.

The Lynn Gas and Electric Company is to have a filtration plant erected.

The Webster (Mass.) Felt and Rubber Company is to install new machinery.

The Lonsdale Company, Cumberland, R. I., will install new power-house equipment.

The Prentice Rule Company, Middletown, Conn., will move its plant to Bridgeport.

A. O. Rothenburg, 42 Court street, Boston, Mass., is in the market for a steam boiler.

The Whaling City Mills, New Bedford, Mass., will install boilers, engine and pumps.

The Kibbe Brothers Company, Springfield, Mass., will install a 150-horsepower engine.

The plant of the Alfred Burke Comb Company, Leominster, Mass., was damaged by fire.

The H. E. Bartlett toy factory, Leominster, Mass., was destroyed by fire. Loss, $35,000.

The Snell Manufacturing Company, East Brimfield, Mass., is to install a large dynamo.

The Hume Carriage Company will erect a factory on Commonwealth avenue, Boston, Mass.

C. S. Taylor and Merle Ball, Hope Valley R. I., will start a woolen mill at Quinapoxet, Mass.

The Missisknoi Lumber Company, Richford, Vt., is making additions to its power plant.

The Rhode Island Coöperative Coal Company, Providence, R. I., is to install a steam boiler.

J. L. Nutter, 47 Liberty street, Quincy, Mass., is in the market for hoisting machinery.

The Springfield (Mass.) Gaslight Company is to install new apparatus costing $250,000.

The Wakefield (R. I.) Water Company will install a pump of 4,000,000 gallons daily capacity.

Executive board of United Shoe Workers of America is to erect a model shoe plant at Lynn, Mass.

The plant of the Acme Fibre Company, Manchester, N. H., was destroyed by fire. Loss, $30,000.

The Lorraine Manufacturing Company, Pawtucket, R. I., will install two 250-horsepower boilers.

The town of Old Saybrook, Conn., is in the market for electrical equipment. Address Wm. H. Smith.

P. Powell, 100 Austin street, Cambridge, Mass., is in the market for an air compressor and storage tank.

The Dwyer-Mortimer Shoe Company, Pittsfield, Mass., is said to be considering the removal of its plant.

F. L. Hervey & Co., belt and belting manufacturers, Fall River, Mass., are to expend $10,000 for a new factory.

The Lehigh Valley Silk Company, of South Bethlehem, Penn., has leased a mill at Westerly, R. I., and will equip same.

The repair department of the Shaw Furniture Company, Quincy, Mass., was badly damaged by fire. Loss, $10,000.

The Hoosac Cotton Mills, North Adams, Mass., is contemplating changes and enlargement in its power-house equipment.

The Rosemount Dyeing Company, Woonsocket, R. I., is to rebuild its plant recently destroyed by fire at a loss of $50,000.

Charles M. Howell, button manufacturer, is making additions to his factory at Waltham, Mass., same to be used for manufacturing purposes.

The Old Colony Manufacturing Company, Taunton, Mass., has been organized with $200,000 capital to make cotton, silk and woolen goods. H. M. Lovering, president.

The Edgemere Mills, Great Barrington, Mass., are to be changed to Barrington Mills, and a new yarn mill is to be built costing $25,000.

J. M. Grosvenor & Co., manufacturing chemists, Boston, Mass., have leased a three-story plant in Lynn, Mass., and will remove their plant to that city.

The Brockway Smith Corporation, Boston, Mass., manufacturer of doors, sashes and blinds, has leased a large building in that city and will operate same.

The Mt. Carmel (Conn.) Trap Rock Company, whose plant was recently destroyed by fire, has reorganized with $50,000 capital and will rebuild its plant.

The Oxford Soap Company, Manchester, Conn., has bought a large tract of land at Russell, Mass., and will immediately open a mine for feldspar and quartz.

W. B. S. Whaley, of Providence, R. I., has charge of planning buildings and buying equipment for a cotton mill, which the Shawnee Development Company will erect at Shawnee, Okla.

The Fisk Rubber Company, Chicopee Falls, Mass., is erecting a four-story addition, 187x36. A new engine house will be built and an addition to the boiler house. A new engine and new electrical equipment will be added.

The Fifteen Mile Power Company has applied to the Vermont legislature for a charter to build on the Connecticut river, near Waterford, Vt., a hydroelectric plant of over 25,000 horsepower to cost between $3,000,000 and $4,000,000.

MIDDLE STATES

Troy (N. Y.) Rubber Stamp Works was burned.

Fire damaged the cheese factory of George Crill, East Floyd, N. Y.

The Hansen Malting Company, Milwaukee, Wis., is erecting a new plant.

Car Milling Company's plant, at Hamilton, Ohio, was burned. Loss, $200,000.

The Republic Lumber Company, of Marinette, Wis., will build a shingle mill.

The Gardner Governor Company, Quincy, Ill., will install a new power plant.

The plant of the Carr Milling Company, Hamilton, Ohio, was destroyed by fire.

The Bavarian Brewing Company, Toledo, Ohio, will erect a new bottling plant.

P. & J. Blum, of West Bend, Wis., will build a box factory at Marshfield, Wis.

Mayor Preuzlow, Clintonville, Wis., is planning to establish a small packing plant.

The pumping station of the Soo railway, at Abbottsford, Wis., was destroyed by fire.

The Sanitary Mattress Company, Youngstown, Ohio, has plans for a new factory.

The Borden Company will establish an evaporating plant at Genoa Junction, Wis.

The Cleveland (Ohio) Electric Illuminating Company is erecting a new power house.

The Shelby (Ohio) Pipe Company is looking for suitable site on which to erect a new plant.

The plant of the Healey Window Glass Company, at Hazelhurst, Penn., was burned. Loss, $75,000.

The T. J. Derwent Company, Rockford, Ill., is in the market for new equipment for its planing mill.

It is reported the Union Bag and Paper Company, Hudson Falls, N. Y., will erect another paper mill.

The Yingling-Martin Brick Company, Johnsonburg, Penn., contemplates installing an electric generator.

C. R. Thompson, Richland Centre, Wis., is making plans for a municipal electric-light plant at Viola, Wis.

The Ohio Broom and Supply Company, Toledo, Ohio, will move into a large building and double its output.

The plant of the Trussed Concrete Steel Company, Youngstown, Ohio, was destroyed by fire. Loss, $75,000.

The South Bend (Ind.) Waterworks is planning extensive improvements in its pumping station at Leeper Park.

Russell, Burdsall & Ward Co., Sterling, Ill., considers building of a new boiler house and improving their power plant.

A. D. Orner, Du Bois, Penn., will enlarge its planing mill. Two additional woodworking machines will be installed.

The P. S. Van Kirk Mill, Lakeview, N. J., will install two new boilers and make other improvements in its power house.

The city council, of Bedford, Ind., has decided to install new electric pumps at the waterworks to cost about $8000.

The plant of the Gallupp-Ruffing Company, Norwalk, Ohio, manufacturing wooden handles, was burned. Loss, $40,000.

The Merriman Solidified Oil Company, South Bend, Ind., will move to Findlay, Ohio, where a new plant will be erected.

Extensive improvements are being made by the K. Schreier brewery, of Sheboygan, Wis. More machinery will be added.

W. B. Saunders & Co., publishers, will erect a seven-story building at Washington square and Locust streets, Philadelphia, Penn.

The Hyde-Murphy Company, Ridgway, Penn., is erecting a new building for the manufacture of doors and hardwood trimming.

L. K. Wynn, of Black Silk Stove Polish Works, Sterling, Ill., says an addition will be built to its plant. New machinery will be needed.

A new power house will be erected by the Gas and Electric Company, at Pottstown, Penn., and a substation will also be built at Sanatoga.

A. E. Bowd, architect, Lansing, Mich., will furnish plans and specifications for a new addition to the Michigan Agricultural College chemical department.

The Highland Paper Company, Johnsonburg, Penn., is erecting a new boiler house. Will install four new boilers to take the place of twelve now in use.

A lighting plant will be built at Rio, Wis., by the Columbia Electric Light and Power Company, of Pardeeville, Wis. M. L. Aldrich, Pardeeville, Wis., superintendent.

The Snell Creamery Company will build a new creamery and ice-cream factory at Highland Park, Detroit, and will install a power plant and refrigerating machinery.

The Auto City Brewing Company, a new company, will erect a plant on McDougal avenue, Detroit. The plant will be thoroughly equipped with machinery and power plant.

Clark Thomas & Son, whose handle and hub factory, at Walesboro, Ind., was recently destroyed by fire, have purchased ground at Columbus, Ind., and will build a much larger plant there.

The American Carton Company, Chicago, Ill., has been organized with $40,000 capital to manufacture paper boxes and receptacles. Incorporators, M. Wendt, M. M. Herriman, P. J. Maguire.

The Wayne Cold Storage Company, East Williamson, N. Y., has been incorporated to do a general cold-storage business. Capital, $50,000. Incorporators, Jos. J. Gates, R. C. Wilson, D. Wagemaker.

The John Dulweber Company, Cincinnati, Ohio, has been organized to manufacture and sell lumber and timbers by B. F. Dulweber, John Dulweber, J. N. Powers, Edward Ehme, etc. Capital, $250,000.

The Moberly Paving Brick Company, Canton, Ohio, has been incorporated with a capital of $300,000 to manufacture all kinds of brick, etc., by C. W. Keplinger, James G. Barbour, A. P. Maurer, etc.

Bellaire Wall Paper Company, Bellaire, Ohio, has been formed with $25,000 capital to manufacture wall plaster, limestone and cement products by R. L. Bowman, Charles Wassmann, John R. Gone, etc.

The Independent Rubber Company, Akron, Ohio, has been incorporated with $10,000 capital to manufacture and sell all kinds of rubber articles. Incorporators, D. G. Rogers, A. J. Rowley, Grace A. Sidefield, etc.

SOUTHERN STATES

The Martinsburg (W. Va.) Power Company will install a turbogenerator.

The Staunton (Va.) Lighting Company will install a 500-kilowatt turbogenerator.

The Surry Lumber Company, Norfolk, Va., is building a new factory with modern power plant.

The Lynnhaven Hotel, Norfolk, Va., will install a new ice plant in connection with its power plant.

The Old Dominion Development Company, Richmond, Va., will spend $130,000 in erecting a coal-handling plant, etc., at its mines.

The Greenville (S. C.) Mantel and Manufacturing Company, recently organized, has commenced the construction of a plant at Pendleton and Markley streets.

WEST OF THE MISSISSIPPI

The city of Brownsville, Ore., will install a new sewer system.

The McIntosh (Wash.) Lumber Company's mill was burned. Loss, $100,000.

The city of Monmouth, Ore., contemplates improvements in its water system.

The city of Santa Barbara, Cal., will make improvements in its water system.

Fire destroyed the Kimball-Lacy Mills, Arkansas City, Ark. Loss, $50,000.

The L. Harback Furniture Company, Des Moines, Iowa, will erect a new factory.

The Standard Lime and Brick Company, Missoula, Mont., is building a new plant.

The Adel Manufacturng Company, Des Moines, Iowa, will build a glove factory.

Fire destroyed the plant of the Clinton (Iowa) Milling Company. Loss, $20,000.

The city of Arlington, Ore., contemplates the installation of an electric-light plant.

The Hope (Idaho) Lumber Manufacturing Company will erect a new and larger mill.

The city of Eugene, Ore., is contemplating the installation of a municipal lighting plant.

W. P. Bates, South Pasadena, Cal., is contemplating the establishment of a lumber mill.

The boiler house, at the city light plant, at Hibbing, Minn., was burned. Will be rebuilt.

The city of Chino, Cal., will install a new domestic water system. Bonds will soon be voted.

O. Aureswald and James Nerly, Spokane, Wash., will build a shoe factory on Standard street.

The Perfection Food Cereal Company, Spokane, Wash., is planning for the erection of a factory.

T. Ballentyne, Rigby, Idaho, whose lumber mill was destroyed by fire, will rebuild the plant.

J. C. Morgan, Austin, Ind., is contemplating the erection of a canning factory at Tucson, Ariz.

The Black Hills Brewing Company, of Central City, S. D., will construct a $60,000 malt house.

The city of Seattle, Wash., will build a 2000-horsepower hydroelectric power plant on Lake Union.

A franchise has been granted Peter A. Orth, at Menno, S. D., to install an electric-light system.

The city of Butte, Mont., has asked permission of the city council to purchase a rock crusher.

J. E. Englehorn, Kooskia, Idaho, has been granted a franchise for an electric-light and power plant.

I. B. Parsons, Haywards, Cal., has applied to the city for a franchise for an electric street railway.

The Thurston County Fruit Growers' Association, Olympia, Wash., will build a small feed-mill plant.

The Redondo Water Company, Redondo Beach, Cal., will expend $25,000 in improving its system.

The Pioneer Plaster Company, Seattle, Wash., is contemplating the installation of new machinery.

The city of Helena, Mont., will install a municipal water system. Bonds for $650,000 have been voted.

The city council, at Henry, S. D., has granted a franchise to the Henry Light and Power Company.

The Telluride Power Company, Ely, Nev., contemplate the erection of a power plant on Cleveland creek.

M. Kulien, Centralia, Wash., will establish a shoe factory in conjunction with his present glove factory.

The Sparr Fruit Packing Company, Ventura, Cal., is contemplating the erection of a new packing house.

The city of Redlands, Cal., will install an ornamental street-lighting system. Estimated cost, $14,000.

The city of Imperial, Cal., will make improvements in its sewer system. Bonds for $9000 will be voted.

The substation of the Fort Dodge, Des Moines & Southern Railroad, at Boone, Iowa, was destroyed by fire.

Balfour Guthrie Company has secured 40 acres at Bellingham, Wash., for the construction of a cement plant.

The city of Elgin, Ore., is contemplating improvements in its sewer system. Bonds for $30,000 will be voted.

Thomas J. Overstreet, Beaumont, Cal., is at the head of an enterprise to build a broom factory in this vicinity.

The Mexican National Gas Company, Mexico City, Mex., is contemplating increasing the capacity of its plant.

The Hemet Canning Company, Hemet, Cal., will build a new canning factory. Modern machinery will be installed.

The Northland Steamship Company, Seattle, Wash., will install a cold-storage plant on its steamship, "Northland."

The North American Oil Consolidated Company, operating in the Midway district, Cal., is building a new boiler plant.

The Security Trust Company, Spokane, Wash., will install an irrigation system in its 40-acre Pinecroft Terrace tract.

The Artesia Lumber and Cement Company, Artesia, Cal., has commenced the erection of a planing mill and sash factory.

The Coos Bay Creamery Company, Marshfield, Ore., will build a condensed-cream factory. Plans are being prepared.

Marcus Nelson, secretary of the Creamery Association, at Tamarack, Minn., will receive bids for the erection of a creamery.

The Pacific Commercial Company has applied to the Chamber of Commerce, Klamath Falls, Ore., for a site for a sawmill.

The Orr Lake Lumber Company, Edgewood, Siskiyou county, Cal., will increase the capacity of its mill to 40,000 feet per day.

The boiler and engine house and equipment of the Santa Fe Railroad, near Bakersfield, Cal., was destroyed by fire. Loss, $5000.

The Pacific Telephone Company, Klamath Falls, Ore., is planning to remodel its plant. Thirty thousand dollars will be expended.

The main building of the Waterloo & Cedar Falls Union Mill Company, at Cedar Falls, Iowa, was destroyed by fire. Loss, $50,000.

The city of McMinnville, Ore., will make improvements in its water system to cost $30,000. Bonds for this sum will be voted.

C. E. Rumsey, Pachappa station, Riverside, Cal., will build an addition to his packing house. Modern facilities will be installed.

The Hunt Perfect Baking Powder Company, Minneapolis, Minn., contemplates the erection of a $25,000 plant at Minneapolis.

The Hayward Timber Company has been incorporated at Everett, Wash., by Daniel O. Shook. The company will build a shingle mill.

Thos. Thompson, of Burlington, Iowa, and F. Dutton are planning the erection of a $20,000 condensed-milk plant, at Brighton, Iowa.

The Northwest Packing Company, Lewiston, Idaho, is planning to erect a packing plant and cracker factory. Modern equipment will be installed.

The Shope Patent Brick and Tile Company has been incorporated at Tacoma, Wash., by J. E. Reynolds and G. B. Halbert. Capital stock, $25,000.

J. A. Edwards, Lake Arthur, N. M., is at the head of an association which will build a canning factory to cost $10,000. Plans are being prepared.

The packing house of the West Highland Citrus Association, Highland, Cal., was destroyed by fire. Loss, $20,000. The plant will be rebuilt.

The city of Tacoma, Wash., will expend $1,500,000 on its proposed gravity water system on Green river. Bonds for this amount have been voted.

The Miller Hey Construction Company, of Waterloo, Iowa, may locate a plant at Albert Lea, Minn., for the construction of concrete and steel bridges.

The Los Angeles Gas and Electric Company, Los Angeles, Cal., is planning for extensions and improvements, which will total close to $1,000,000.

The fertilizer and rendering plant of the Carstens Packing Company, Tacoma, Wash., was destroyed by fire. Loss, $50,000. The plant will be rebuilt.

The city of El Centro, Cal., is planning for a bond issue for improvements in its sewer and water systems. New pumping machinery will be required.

The Chicago, Milwaukee & St. Paul Railroad Company will establish a concrete plant at Wabasha, Minn., for the manufacture of concrete piling culverts.

W. F. Holt, El Centro, Cal., is investigating conditions in the Coachella valley, and if findings warrant, will build a power plant to supply this vicinity.

The Barber Asphalt Company's plant, at Albina (near Portland), Ore., was damaged by fire to the extent of $20,000. The plant will be rebuilt at once.

The Spokane Concrete Company, Spokane, Wash., will erect a new factory. The best equipment for the manufacture of cement products will be installed.

The Fillmore Cement Plaster Company, Fillmore, Cal., will build a new factory building. The company plans for further additions in the near future.

The Whittier Citrus Association, Sunnyslope district, Whittier, Cal., will build a large addition to its packing house. Modern facilities will be installed.

The Hovey Sash and Door Manufacturing Company has been incorporated at Los Angeles, Cal., by S. P. and W. A. Hovey, with a capital stock of $25,000.

The Central Sash, Door and Lumber Company has been incorporated at Bay City, Ore., by A. L. and E. L. Stone and W. M. Heacock. Capital stock, $10,000.

C. F. Clafflin and F. M. Wells, White Bluffs, Wash., are planning for extensive irrigation work. Water will be raised from the Columbia river by electric power.

Power-plant equipment, etc., will be required in the new hotel to be erected at Portland, Ore., by the R. Thompson estate (C. K. Henry, agent). Cost, $700,000.

The Hemet Ice Company (W. E. Kimmell, manager), Hemet, Cal., will double the capacity of its ice-manufacturing plant. Modern machinery will be installed.

A 90-horsepower mechanical plant and ventilating and heating system will be installed in the new hotel to be erected at Fresno, Cal., by the Fresno Hotel Association.

A power plant will be installed in the new Polytechnic High School to be erected at San Francisco, Cal. A. I. Coffey, city architect, San Francisco, is preparing plans.

The Calzona Land Company, Los Angeles, Cal., is having plans prepared for a waterworks plant and power station to be built at Calzona, Cal.; $45,000 will be expended.

Superintendent C. W. Kolner, of the Pasadena, Cal., municipal light plant, has been authorized to expend $1000 in electrical-construction material and operating supplies.

The city clerk, Colton, Cal., has been instructed to advertise for bids for furnishing the city one 600 cubic feet per minute air compressor, two motors and two transformers.

The J. H. Overhauser Candy Company, Spokane, Wash., will install new machinery at its plant. The company contemplates the erection of a new factory some time in 1911.

Refrigerating plant will be installed in the new Casino building to be erected by the Anheuser-Busch Brewing Company, at Santa

Monica, Cal. About $100,000 will be expended.

The Riverside Portland Cement Company, Riverside, Cal., has commenced construction on its new plant. The present capacity will be doubled. About $1,000,000 will be expended.

The Winnemucca (Nev.) Water and Light Company is contemplating the installation of a 500-kilowatt direct-connected steam turbine driven unit, also water-tube boilers fitted for burning oil.

The Board of Public Works, Los Angeles, Cal., has recommended the purchase of a machine power drill for use of the city engineer in harbor work, at San Pedro. Estimated cost, $3000.

The Yuma Ice and Cold Storage Company, Yuma, Ariz., has let the contract for the erection of a new storage building; modern equipment will be installed, including precooling apparatus.

The Sterling Silver Lead Company (W. W. Warner), has been granted a franchise at Metalline Falls, Wash., to operate a telephone and electric power system and to construct waterworks.

The Thousand Springs Power Company (R. G. Roberts), Mountainhome, Idaho, will build a power plant on Snake river; a pumping plant will be installed near Brown's flats. $300,000 will be expended.

The Chehalis & Cowlitz Railroad Company has been incorporated at Chehalis, Wash., by H. C. Hoffman and G. A. Robinson, with a capital stock of $300,000. An electric line will be constructed 20 miles long.

The Suburban Irrigation Company, Tacoma, Wash., has been incorporated for $150,000 by Wm. Jones and Wm. Virges. The company is planning extensive irrigation operations on the American Lake district.

The Newbert Protection district, Orange county, Cal., will make extensive improvements in its irrigation system. R. H. English, Phillips building, Santa Ana, Cal., is president of the board; $89,000 will be expended.

The Dickson Flexible Hose Company, Houston, Tex., has been incorporated with $200,000 to manufacture a metallic hose invented by W. M. Schultz. Incorporators are Geo. M. Dickson, H. M. Dickson, C. M. Rein, etc.

The Gila River Power Company, Clifton, Ariz., is planning for extensive power developments and irrigation work in Grant county, New Mexico. Plans for a dam have been approved by the Territorial engineer of New Mexico.

The Carlsbad Guano and Fertilizer Company has been incorporated at San Bernardino, Cal., by J. D. Langford, A. Gregory and H. B. Hinckley, of Redlands, with a fully paid capital of $50,000. The company will build a plant here at an early date.

CANADA

The Art Glass Company, of Berlin, Ont., will double its factory.

Victoria, B. C., will spend $25,000 for new electric-light machinery.

Bowmanville, Ont., will install a complete new waterworks system.

Harriston, Ont., will spend $35,000 for new pumping machinery.

Toronto, Ont., will spend $700,000 extending its waterworks system.

The Winnipeg Electric Company is building a large turbine power house.

The Ken Knit Company will build a large new factory at Woodstock, Ont.

Camrose, Alberta, will spend $100,000 installing a new waterworks system.

Hartt Boot and Shoe Company, Fredericton, N. B., will erect a large addition.

The L. McBrine Company, of Berlin, Ont., trunk manufacturers, will double its factory.

The Dominion Graphite Company is building a large new factory at Buckingham, Que.

The city of Strathcona, Alberta, is calling for tenders for engines, boilers and generators.

The Maritime Coal, Railway and Power Company will open another colliery at St. George.

The Felt Boot and Rubber Company, of Berlin, Ont., will build large extensions to its factory.

The entire plant of the Moosejaw *Daily Times*, was wiped out by fire; will be replaced. Loss, $125,000.

The Patrick Burns Company will probably erect a packing plant at a cost of $1,000,000 at Edmonton, Alberta, Canada.

MINING

The Great Gold Belt Mining Company, operating near Amboy, Cal., is building a 20-ton mill.

The Evening Star mine, Shasta county, Cal., is planning for extensive development work.

The Red Top Extension property, near Goldfield, Nev., will install new machine drills.

The Eagle mines, in the vicinity of Tonopah, Nev., will install new hoisting equipment.

The Kenai-Star Mining Company, operating near Hope, Cook inlet, Alaska, will install a new mill.

J. and E. J. Barnes, operating on Crow creek, near Seward, Alaska, will install a stamp mill.

The Yankee Girl Gold mines, Ymir, B. C., is contemplating the erection of a concentrating plant.

The Dome mines, near Cobalt, Ont., Canada, is reported to be engaged in erecting a 40-stamp mill.

The Jacalitos mine (J. Loftus), near Ensenada, Lower California, is erecting a 10-stamp mill.

The Guadalupe-Fresnillo mine, Pachuca district, Hidalgo, Mexico, is building a 200-ton cyanide plant.

The Hamm properties, at South Forks, N. M., will install a tramway system and erect a 50-ton mill.

The United Verde Copper Company, operating at Jerome, Ariz., will build a power plant to supply its mines.

The California-Alaska Mining Company, operating in the vicinity of Seward, Alaska, will build a 2-stamp mill.

The Hidden Treasure mine, Turkey creek district, near Prescott, Ariz., will add cyanide equipment at its mill.

The Lake Valley Mines Company, operating in Lake Valley, Grant county, N. M., will build a smelting plant.

The San Rafael properties, at Guanacevi, Durango, Mexico, are contemplating extensive development work.

The Argue Oil Company, operating in the Templor district, McKittrick, Cal., will install new rotary equipment.

The Santo-Nino mine, in the Parral district, Mexico, contemplates installing a reduction plant in the near future.

The Tightner mine, Sierra county, Cal., is contemplating the installation of an air compressor and power drills.

The Kenai-Alaska Company, operating in the Falls Creek district, near Seward, Alaska, will install a 3-stamp mill.

The Chelan Butte Gold Mining Company, operating at Chelan, Wash., is planning for extensive development work.

F. R. Stewart, operating near Hope, Cook inlet, Alaska, is planning for extensive development work in the spring.

The Alder Creek Mining Company, operating in the Black Hills district, South Dakota, will build a large cyanide plant.

The Brooklyn Development Company, operating on Archangel creek, near Seward, Alaska, is installing a new mill.

The Allie Mining Company, operating at Gilmore, Lemhi county, Idaho, is contemplating the erection of a cyanide plant.

The Bunker Hill & Sullivan Mining Company, operating near Wardner, Idaho, is building a new addition to its mill.

The Gold Ship Mining Company, operating near Groveland, Tuolumne county, Cal., will install new pumping equipment.

The Campos de Oro Placer mines, near Santa Ana, Sonora, Mexico, will install a sampling plant of 100 tons capacity.

The Dillon Petroleum Company, operating in the Templor district, near McKittrick, Cal., will install new pumping equipment.

The Hines Consolidated Mining Company, operating at Santa Barbara, Mexico, is planning for extensive development work.

The Marsh Mining Company has leased the Pittsburg Lead Company's mill at Mullan, Idaho, and will install new machinery.

The Portland Mining Company, operating in the Black Hills district, S. D.; will soon be in the market for an aërial tramway.

The Seward Gold Company, operating on Ground Hog creek, vicinity of Seward, Alaska, will install a new mill in 1911.

The Bullfrog Pioneer Consolidated Mining Company, operating near Goldfield, Nev., is planning for extensive development work.

The Summit Copper Company, operating near Globe, Ariz., is making tests for determining proper machinery to treat its ore.

The North Washington Power and Reduction Company, operating near Republic, Ferry county, Wash., is building a cyanide plant.

Samuel I. Silverman, operating in the Talkeetna district, near Seward, Alaska, will install new diamond drills in the near future.

Finch & Campbell, Spokane, Wash., operating in the Cañon creek section, Alaska, are planning for extensive hydraulic operations.

The Bi-Metal mines, near Kingman, Ariz., are making tests of their property. If findings justify a large milling plant will be built.

The Carcol Mining Company, operating near Rosario, state of Sinaloa, Mexico, will remodel its mill and install cyanide equipment.

The Federal Mining and Smelting Company, operating in the Cœur d'Alene district, Idaho, is planning for extensive development work.

The Black Hills Development and Financial Corporation, operating at Carbonate, Black Hills district, S. D., will build a smelting plant.

The Nevada-Hills mine, Fairview, Nev., is reported to be contemplating the erection of a stamp mill of 500 tons capacity some time in 1911.

The National Mines Company, National, Nev., will install a mill of 100 tons capacity. John E. Pelton, president and general manager.

The Sandstorm-Kendall Consolidated Mining Company, operating in the Goldfield, Nev., district, is planning for extensive development work.

The Matanuska Gold Mines Company, operating on Archangel creek, vicinity of Seward, Alaska, is planning for extensive development work.

It is reported that the Tisdale Mining Company, operating in the Porcupine district, Ontario, Canada, is contemplating extensive development work.

The Campo Bonito mine, near Tucson, Ariz., will increase the capacity of its mill 50 tons. Col. W. F. Cody is principal owner of this property.

The Twin Buttes Mining Company, operating near Tucson, Ariz., will expend $100,000 during the present year in improving its property and equipment.

The Aladdin Mining Company, operating in the Deep Creek district, Northport, Wash., will install an air compressor, waterwheel and power equipment.

The Eighty-Five Company, operating near Lordsburg, N. M., will install a steam plant for pumping and lighting. New gasolene hoists will be installed.

The British Columbia Copper Company, operating the Napoleon mine, Toulon mountain, Orient district, Wash., will install a 250-stamp mill in the spring.

The Homestake mine, in the Black Hills district, S. D., is building a power plant. The power house will be thoroughly equipped, contract for part has been let.

The Anaconda Copper Mining Company, Anaconda, Mont., will soon be in the market for equipment for the construction of a plant for the treatment of slimes.

The Kootenay Gold Mines, Ltd., operating the Granite-Poorman mines, near Nelson, B. C., will double the capacity of its 20-stamp mill and cyanide plant.

J. P. Warr, manager of the Blaisdel Cascotitlan Syndicate, Pachuca, Hildago, Mex., is at the head of consolidated interests to build a 100-ton mill in the El Chico district.

The Gold Bullion Company, operating in the Willow creek district, near Seward, Alaska, is installing an aërial tramway. The capacity of the stamp mill will be increased in 1911.

The Mountain Lion mine, in the Republic district, Ferry county, Wash., has been bonded by Walter E. Trent, Los Angeles, Cal. The milling plant will be remodeled and new machinery installed.

The Ojai Valley Petroleum Company, operating in the Kern river field, near Bakersfield, Cal., is preparing to remove to Santa Paula cañon and plans extensive development work.

E. H. Mack, Fairbanks, Alaska, is at the head of an enterprise to operate extensively in this vicinity. The company is planning to bring new equipment in the fields; core drills will be required.

Business Items

The B. L. Company, Norwich, Conn., has been organized and will manufacture a complete line of radial ball bearings. The officers of the company are O. Bruenauer, president, and B. F. Leavitt, secretary and treasurer.

The George Whiting Company, formerly located at 1417 West North avenue, Chicago, Ill., moved on February 1 its office and works to its own new quarters at 1701-1719 Elston avenue, Chicago, Ill., where it has considerably more room and proposes to greatly increase its present facilities.

The Simonds Manufacturing Company, Fitchburg, Mass., announces that its new steel mill, at Lockport, N. Y., on which construction work began early last summer, is now in full operation. The first steel in this plant was rolled on January 2. There is a separate rolling mill for band-saw plates, crosscut-saw plates and circular-saw plates. Ample room is also provided for plates for Simonds hand saws and steel specialties. One general building is located adjacent to the ends of the rolling mills for the making of steel ingots.

Cammell, Laird & Co., Ltd., one of the three greatest steelworkers and shipbuilders in Great Britain, who have just been awarded a contract of $10,000,000 by the British government for the construction of one of the new dreadnaughts, have formed an American company to handle their products in this country. This new American corporation is known as Cammell, Laird & Co., of New York, and its main office and warehouse will be at 34 Cliff street, New York City. The company will carry a large stock of English tool and high-speed steel, as well as other specialties, such as nickel and chrome nickel steel for automobile parts, heavy forgings for ships, rolling mills, sugar mills, etc. The new corporation will represent not only Cammell, Laird & Co., Ltd., of Sheffield, but all its allied interests, such as The Cyclops Steel and Iron Works, of Sheffield, the Yorkshire Steel and Iron Works, the Orisesthorpe Ordnance, Steel Tyre and Spring Works, and the Shipbuilding Works, at Birkenhead.

Forthcoming Meetings

American Supply and Machinery Manufacturers' Association, National Supply and Machinery Dealers' Association and Southern Supply and Machinery Dealers' Association; joint annual convention, Hotel Seelbach, Louisville, Ky., April 3-5, 1911. F. D. Mitchell, secretary, 309 Broadway, New York City.

National Metal Trades Association, annual meeting, April 14, 1911, New York City, Hotel Astor. Robert Wust, commissioner, New England building, Cleveland, Ohio.

American Foundrymen's Association, annual convention, Pittsburg, Penn., May 23 to 26, 1911. Richard Moldenke, secretary, Watchung, N. J.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

Philadelphia Foundrymen's Association; meetings first Wednesday of each month, Manufacturers Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday for ensuing week's issue. Answers addressed to our care, 505 Pearl Street, New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

Miscellaneous Wants

Caliper catalog free. E.G.Smith, Columbia, Pa.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Wanted—Work for screw machines and gear cutter. Box 775, AMERICAN MACHINIST.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Wanted—Contract work or medium weight specialties to build. Wm. A. Cather, Pottsville, Penn.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

The Brunswick Refrigerating Co., of New Brunswick, N. J., are prepared to take on one or more manufacturing propositions.

Wanted—To purchase established general machine shop in live town of 5000 to 10,000; give name of banker. Box 457, AM. MACH.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Wanted—An article to manufacture suitable for the railway, automobile or hardware trade; must be patented and exclusive. Address Box 356, AMERICAN MACHINIST.

General foreman invites correspondence with parties interested in building kerosene motors; have patent pending; European practice in oil motors. "O. M.," AMER. MACH.

Tools, dies, jigs and light and medium weight machinery designed and built to order; duplicate parts, either machined or die cast. Precision Die Casting Co., Syracuse, N. Y.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan is wanting good agencies for machine tools of all kinds. Box 189, AMER. MACH.

Engineer with fine offices located in the business part of Pittsburg, Penn., wants to represent first class company; has first class salesmen and draftsmen employed; can take care of all business, including estimating and designing, etc. Box 443, AMER. MACHINIST.

Factory Facilities Wanted—Small electrical or mechanical articles to manufacture for selling agents; first class factory and equipment already engaged in similar work; practical superintendent in charge. Address, with and for particulars, Factory, Box 167, Boston, Mass.

Partner wanted for long established foundry and machine shop in a thriving Southwestern town; must be an all-around mechanic in the machine shop and able to superintend the foundry in a general way; the right party will get good inducements; do not apply unless you are an experienced mechanic and want to invest $2000. Reply to "Partner," Box 450, AMER. MACHINIST.

Help Wanted

Classification indicates present address of advertiser, nothing else.

CONNECTICUT

Wanted—First-class toolmaker in Connecticut. Box 389, AMERICAN MACHINIST.

Wanted—First class draftsman, one experienced on jig and fixture work; Connecticut. Box 388, AMERICAN MACHINIST.

Wanted—A first class temperer, with experience in hardening German high-grade steel; permanent position in Connecticut; give age and references. Box 446, AM. MACH.

ILLINOIS

Wanted—Salesmen for factory and machine shop trade to sell a good small tool as side line; liberal commission. Write Box 461, AMERICAN MACHINIST.

INDIANA

Wanted—A chief inspector by a large automobile company in Middle West; must have had extensive experience as an inspector in a position of responsibility; good salary and steady employment to the right man; none but high class energetic man need apply. Box 447, AMERICAN MACHINIST.

IOWA

Wanted—Draftsman, experienced in designing dies for heavy machine work; prefer one acquainted with hydraulic machinery. Box 357, AMERICAN MACHINIST.

MASSACHUSETTS

Wanted—An experienced mechanical draftsman, preferably with a technical education, or a number of years' practical shop experience, by a large manufacturing concern in Massachusetts; state age, experience and salary expected by addressing "Chief Draftsman," Box 383, AMERICAN MACHINIST.

MICHIGAN

Wanted—At Jackson, Mich., draftsman, experienced on axle, transmission and general gear work; state full particulars in first letter. Box 361, AMERICAN MACHINIST.

MINNESOTA

Wanted—Cream separator, bowl balancers; good position; answer immediately. Box 375, AMERICAN MACHINIST.

NEW YORK

Machine tool salesman, with mechanical training; such with theoretical and practical knowledge of gear cutting machinery preferred; state salary, experience, former occupation and territory in which best acquainted. Box 386, AMERICAN MACHINIST.

Wanted — General foreman to take full charge of old established factory in New York City, employing about 100 hands in general mechanical and electric manufacturing, light machinery, etc.; must be able to prepare estimates and be familiar with factory systems. Reply by letter, giving full particulars of past experience, salary expected and any other details of interest. Fred'k Pearce Co., 18 Rose St., New York.

Wanted—Chief engineer for large company building excavating and hoisting machinery; must be technical graduate competent to take entire charge of engineering department, systematizing the work and directing the designing of machinery; position permanent; only high grade man need apply; state fully in first letter age, education, experience and salary; all replies treated confidential. Box 424, AMERICAN MACHINIST.

Wanted—Mechanical engineer to take charge of the design and supervise the making of special fixtures, tools and gages, for the interchangeable manufacture of small mechanisms in plant employing over 1000 men; to handle departments satisfactorily man should be familiar with master plate methods used in manufacture of watches, clocks, guns, sewing machines, etc.; executive ability and good judgment in handling men a requisite; state experience in detail, give age and references. Box 452, AMERICAN MACHINIST.

OHIO

Wanted—Jig designer; one thoroughly familiar with the machine tool business and uptodate on modern machine shop practice. Address "TAW," AMERICAN MACHINIST.

Wanted—By a concern in Ohio building heavy machinery, a foreman for gear cutting and milling department; state experience, age and salary expected. Address "N. H.," AM. M.

Wanted—First class machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

Wanted—On account of increasing business company operating six automatic screw machines (Acme and Cleveland) is in need of general manager for that department; applicant must have good education and be capable of taking entire charge of all parts of the work from ordering material to shipping finished product; best of references required and would prefer man who could make a small investment in the business, but that is not essential. Box 418, AMER. MACHINIST.

Wanted — Mechanical superintendent for large engineering works; must have thorough knowledge of and wide experience in modern manufacturing methods. Apply Robert Wuest, Commissioner, National Metal Trades Association, 1405 New England Building, Cleveland, Ohio.

PENNSYLVANIA

First class firm of designing engineers wants engineer to represent them in every State on commission; fine proposition for one who can get results. Box 442, AM. MACH.

Several draftsmen wanted; applications solicited from men with either ordnance, mechanical-electrical, or mechanical structural experience; state fully, age, experience, education and salary expected. Box 429, AM. M.

A leading high-speed engine builder is in need of an experienced superintendent and designing engineer; must be familiar with the best modern shop practice and have had previous experience in steam engine design; salary not so much of a consideration as ability; do not wish to correspond with any one not receiving a good salary now. Box 430, AMERICAN MACHINIST.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

VERMONT

Wanted—First class mechanical engineer and draftsman with sufficient experience and ability to design and lay out machines which will be outlined by the management; good opening for right party; give full experience, wages expected, etc. Box 417, AMER. MACH.

WEST VIRGINIA

Wanted—Man with considerable mechanical experience to superintend large plant manufacturing principally tin cans; capable of successfully handling three to four hundred hands; must have experience and executive ability; reference. "Cans," AMER. MACH.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

CONNECTICUT

Superintendent or works manager with wide experience on tools, dies and general manufacturing; systematic organizer and executive; equal to large proposition; will consider change. Box 408, AMERICAN MACHINIST.

Position as mechanical or general superintendent; 20 years in mechanical and executive positions, six years with present company, manufacturing brass and other sheet metal goods; age 40; references. Box 445, AMERICAN MACHINIST.

Young man, 10 years' practical experience factory cost, systematizing and superintending, desires to change; at present factory superintendent; thoroughly familiar with modern shop methods and machinery; experienced estimator; A-1 references. Box 467, AMERICAN MACHINIST.

ILLINOIS

An experienced designer familiar with machine tools, stamping presses and dies, jigs and fixtures, for manufacturing, etc. Box 464, AMERICAN MACHINIST, Chicago.

Chief engineer or master mechanic, South or Southwest preferred; engines, boilers and general hoisting and mining machinery; eighteen years in present position, but would like to change. Box 466, AMER. MACHINIST.

Works manager, superintendent, production engineer; experience includes direction of machine shop, foundry, structural steel, pattern shop and office, steam engines, turbines and power transmission machinery. Box 451, AMERICAN MACHINIST.

INDIANA

Uptodate patternmaker foreman wishes to change; now in charge of 12 men and large concern; 20 years' experience; eight years foreman; write for reference or interview. Box 427, AMERICAN MACHINIST.

MASSACHUSETTS

Mechanical engineer, technical school graduate, with seven years' practical and two selling experience, desires position; purchasing department preferred. Box 468, AM. MA.

Foreman blacksmith, 39, strictly sober, with 15 years' experience, at present employed as foreman for machine forgers, desires change; capable to take charge of large automobile or machine forge shop. Box 460, AM. MACH.

MICHIGAN

Open for engagement April 1; mechanical engineer, experienced in the design and manufacture of steam, power and centrifugal pumps. Box 373, AMERICAN MACHINIST.

MINNESOTA

Superintendent of small shop by American; wide experience, shop work, chief draftsman, and in charge of outside construction; energetic, reliable. Box 439, AMER. MACHINIST.

NEW JERSEY

Mechanical superintendent wishes change; not a reorganizer, but an efficiency increaser; can get results from help, improve manufacturing methods and simplify clerical systems. Box 453, AMERICAN MACHINIST.

Position as superintendent or works manager; entire charge, a hustler with a record as an earning power, who has never failed to make good; A-1 references; look me up. Address Box 422, AMERICAN MACHINIST.

NEW YORK

First class blacksmith, fully able to take charge of shop, wants steady work. Box 455, AMERICAN MACHINIST.

Mechanical engineer, graduate, designer of cranes, hoisting and steam engines, desires position. Box 469, AMERICAN MACHINIST.

Superintendent and factory manager, with large experience as executive; practical machinist and foundryman; fully qualified to take charge. Box 444, AMER. MACHINIST.

Foreman, designer, tool and gage work, 14 years' experience, cylindrical and thread gages, interchangeable manufacturing, desires responsible position. Box 416, AMER. MACH.

Tool room foreman; practical and executive experience; familiar with all modern tools, dies and manufacturing; expert tool designer; 16 years' experience; best of reference. Box 448, AMERICAN MACHINIST.

Machine designer and mechanic with 14 years' experience, desires change; capable of designing and getting out special machinery or motor cars from ideas furnished; New York City preferred. Box 465, AMER. MACHINIST.

Mechanical superintendent or general foreman, mechanic of high inventive ability, experienced on automatic machine designing and building, also screw machines, sheet metal drawing and general machine work, wishes position as superintendent or foreman. Box 462, AMERICAN MACHINIST.

High grade machinist, tool and die maker, age 30, high degree inventive ability, good technical education, modern methods, designing labor saving devices, improvements, increasing production, foremanship experience, wants position; $30-$35 to start. "Expert," 90 Lenox Ave., Care Prago's, New York.

OHIO

Competent designer and draftsman desires change; age 30; shop experience; western States preferred. Box 379, AMER. MACHINIST.

Position as cost accountant and premium system man in foundry and machine work; 20 years' experience; reference if required. Address 130 Schæffer St., Dayton, Ohio.

Practical works manager or superintendent with twenty years' experience with representative concerns, will make a change about March 1; successful organizer, systematizer and shop administrator; correspondence solicited. Box 449, AMERICAN MACHINIST.

Position as works manager or superintendent; 14 years' experience in executive positions; a hustler having made good handling 2000 employees; ten years with present company; good reasons for changing; can earn $6000 year; age 35 years. Box 396, AM. MA.

PENNSYLVANIA

Draftsman, experienced on jigs, fixtures and shop tools, desires position. Box 459, AMERICAN MACHINIST.

Position as office manager; age twenty-eight; broad range office and machine shop experience; of executive ability; good cost and time accountant; now employed as chief clerk; highest references. Box 458, AM. MA.

Master mechanic and assistant superintendent for large machine shop with long and valuable varied experience, is open for engagement; experience in estimating, maintenance of plant, motive power and tool departments; thoroughly familiar with modern apprentice systems and very successful in handling men; record of the very best. Address "Mechanic," AMERICAN MACHINIST.

VERMONT

Position as foreman desired by all-around machinist and toolmaker; age 27; good education; 10 years' experience in jobbing and manufacturing shops; good knowledge of drafting and designing, also fair knowledge of foundry work; can handle men; East or Middle West preferred. Box 456, AM. MACH.

FOR SALE

For Sale—One motor generator set, 1000 amperes, direct connected to 10-horsepower motor, including base plate and accessories; one 42-inch centrifugal extractor, self-balanced, complete; both absolutely new. For further information, address Fels & Co., 73d and Woodland Ave., Philadelphia, Penn.

An opportunity to start a machine shop; we offer one of our departments for sale, the one used to establish our business; it is small and profitable work, but as we are devoting ourselves to heavier work, we offer to sell for $2000, all the drawings, patterns, and stock of finished and partly finished parts and rough material (inventories over $3000), circulars, electrotypes, special machinery and fixtures, and an established trade. Address Sipp Machine Company, Paterson, N. J.

For Sale or Lease—Machine shop 35x100 feet, substantial brick building and lot 66x280, conveniently located in a good manufacturing town out of Chicago having accessible shipping facilities by boat and rail, including a Chicago outer belt line; machine shop is adequately equipped with working capacity of 25 men or over, a pattern shop for three patternmakers and arranged to equip for foundry; building also includes pattern storage rooms, boiler house and boiler and shipping room; an office building 24x24 feet and casting shed 24x24 feet are included in premises; we are in position to make an excellent proposition to parties interested. Box 463, AMERICAN MACHINIST.

Talks With Our Readers

By The Sales Manager

James H. Collins tells of an incident which happened within his experience and which aptly illustrates a point.

We have heard complaints that every advertising competitor claims that his goods are the "best," that this is obviously impossible and that, therefore, the advertising of all but one must be exaggerated.

Let us see.

A lawyer, says Mr. Collins, bought an old farmhouse, made some changes in its appearance and then wanted a modern heating system to keep it warm.

He wrote to several manufacturers asking that they send representatives who could advise him.

* * *

The first salesman to arrive was a hot-air furnace man.

By the time he got through he had convinced the lawyer that the hot-air furnace was the thing he wanted because it had been installed in three-fourths of American homes, it cost least to install, furnished an abundance of pure outside air, was so simple that a child could operate it, etc.

Two hours later the hot-water apparatus salesman arrived.

He admitted that hot air had real advantages. But with the hot-water system there could be no soot, dust or ashes. Had he considered that? Yes, hot water cost more to install. But, distributed over a lifetime, what did that extra cost amount to yearly? Would he, for the sake of a few dollars, install a system directly opposed to the eternal laws of physics? It was a scientific fact that hot air could not rise against a descending current of cold air. Now, with a steady flow of hot water rising through the house and returning automatically to the boiler to be heated—

By that time the lawyer was ready to look at diagrams.

* * *

Then along came the steam-heater salesman.

Had the lawyer thought over what kind of system he wanted? Yes, he had—hot air seemed cheapest but hot water more suitable.

Both very excellent systems, conceded the steam man. But, would it interest him to know that, if his fire went out while he was away, he might return to find all his hot-water radiators burst by freezing?

True, he could avoid this by draining the entire heating system every time he attended the theatre in freezing weather. But, with steam, all water returns to the boiler, leaving the pipes empty. Then, steam only required one set of pipes which gave economy of installation, etc., etc.

By this time the lawyer was ready to believe that steam was it, but the hot-water man got in his rebuttal testimony and demonstrated that his house would be, with steam, either overheated or freezing contrasted with the steady, even flow of hot water.

Rumor does not say which system was finally installed but it is very evident that the lawyer had to be judge and jury in the final decision.

* * *

Now each of those salesmen was convinced that he had the better proposition for that possible buyer.

Each believed his goods were the best and said so.

All of them had good goods made by reputable manufacturers.

The client could have installed any one of them and had a well heated house.

Each system had some special advantages and some special drawbacks not possessed by the others.

Each salesman could make the statement, in all sincerity, that his was ahead of all other systems.

There never was a father yet who didn't claim and couldn't prove that his baby was the best and brightest ever.

This same thing applies to advertisers.

Because two competing concerns claim to make the best device is no proof that either one is exaggerating or lying.

No wise man buys without analyzing the claims of different manufacturers and basing his decision upon how well the device will suit his requirements.

The position of buyer is no silver-lined cinch. You men responsible for results in machine shops must be keenly alert to every device that will help you produce results.

You must know the good and bad points of them.

No better safeguard exists than to always make a point of investigating and buying advertised goods. For these are the ones that are out in the limelight all the time, inviting investigation, comparison and criticism.

When a man comes out in the open with his claims, he's a good one to do business with.

* * *

Only reliable products can be continuously advertised.